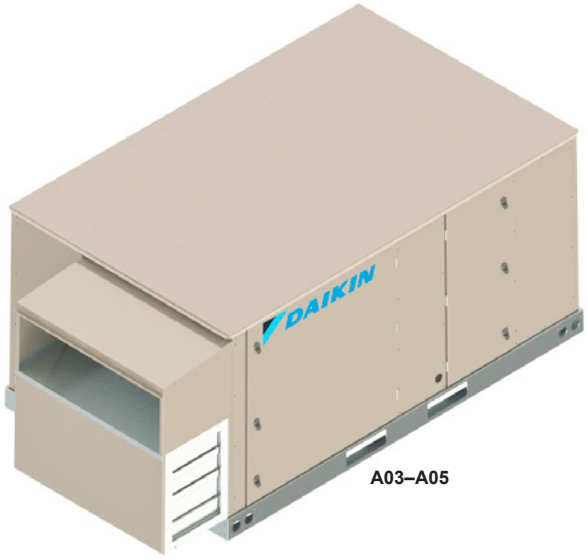
DAIKIN

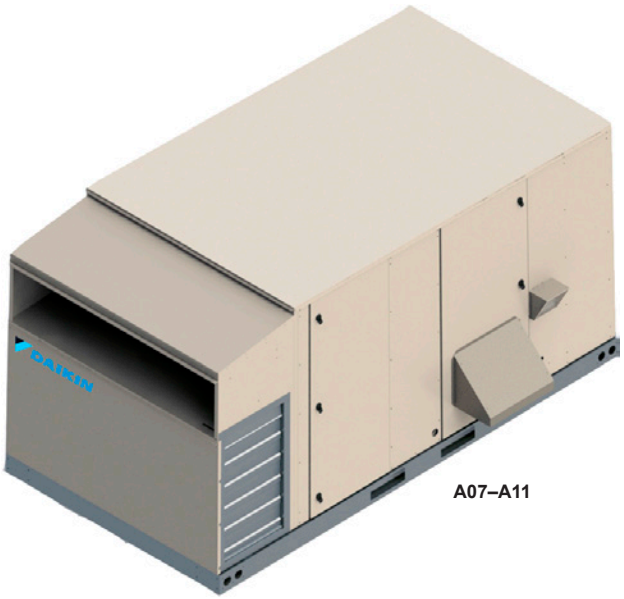
Catalog 571-2

Rebel®
Outdoor Chilled Water
Air Handling Systems

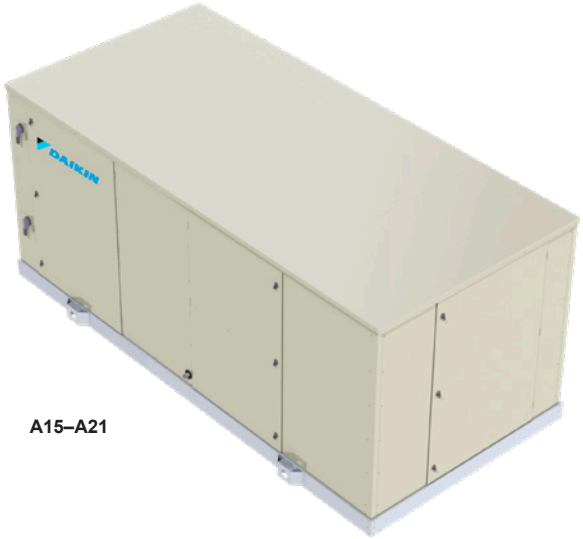
Packaged Heating & Cooling
Models DAH A03 – A21
500 to 11,500 cfm (3 to 21 ft²)
Energy Recovery Wheel, Energy Recovery CORE®



A03–A05



A07–A11



A15–A21

Rebel Outdoor Chilled Water Air Handler

Building on our innovative and award-winning Rebel® heating and DX cooling packaged rooftop platform, comes the new Rebel rooftop air handler. Combined with either Pathfinder® or Trailblazer® air-cooled chillers, Rebel offers engineers and building owners a chilled water solution featuring segment-leading technologies that provide for a complete single-sourced system. Capitalize on the 22+ IPLV performance of an air-cooled chiller and combine it with Rebel's flexible options to precisely match your application needs.

Operate at Higher Levels of Efficiency

Imagine an air handler that reduces fan energy so much that you notice it in your energy expenses and see an increase to your bottom line. Combined with the high performance efficiency of our air-cooled chillers, Rebel does just that. With our embedded technologies:

- Gain up to 15% savings in fan energy with our ECM or direct-drive fans versus traditional belt-driven fans.
- Increase efficiency 30% and exceed AHRI and ASHRAE 90.1-2016 standards with a factory-installed energy recovery wheel that captures and recycles lost energies to produce better energy outcomes for your building.

Improve Sightlines With a Smaller Footprint

Rebel's unitary small footprint with energy recovery is nearly half that of competitor modular units and requires less effort to install. When rooftop mechanical equipment is required to meet local and city sightline codes, specifying engineers can look to Rebel's small footprint and low profile to fulfill aesthetic conditions that architects and municipalities mandate.

Customize Your System With the Right Features and Options

Tailor your HVAC solution to your job and your long-term goals by configuring a system designed around what matters most to you. Rebel's customizable design allows you to build a streamlined air handler with minimal options to fit your budget. Or, design a unique, high-performance air handler loaded with factory-installed features and options. The amount of customization is yours to decide. No surprises here – regardless of what design direction you choose, your air handler will arrive on site as a complete packaged solution that's ready to go.

Agency Listed:

Member of BACnet International
Intertek
AHRI CERTIFIED
LONMARK 3.4

Figure 1: Nomenclature

DAH – A11 – A H H G 4

Daikin Packaged System

Nominal capacity
A03 = 3 sq. t.
A04 = 4 sq.ft.
A05 = 5 sq.ft.
A07 = 7 sq.ft.
A09 = 9 sq.ft.
A11 = 11 sq.ft.
A15 = 15 sq.ft.
A19 = 19 sq.ft.
A21 - 21 sq.ft.

Design vintage
A = Vintage 1

Cooling efficiency
H = High

Line voltage
2 = 208 volt power supply
3 = 230 volt power supply
4 = 460 volt power supply

Heat medium
Y = None (cooling only)
G = Natural gas heat
E = Electric heat
W = Hot water heat

Unit style
W = air handler with cooling coil
Y = air handler without cooling coil

Rebel® Chilled Water Air Handler—Features and Options

1 Multiple cooling coils

- Numerous cooling coil options with different face areas and coil depths

2 Through the base piping connections

- All water piping and water piping connections are internal to the cabinet
- Factory piped lines are pre-insulated

3 Optional factory installed valves

- Software selectable, factory-installed 2-way, 3-way, and isolation valves

4 MicroTech® III unit controller

- Open Choices™ feature provides interoperability with BACnet® and LonWorks® communication options for easy integration with building automation systems
- Unit diagnostics for easy serviceability

5 Hinged access doors

- ¼–turn latch door provide easy access to system components for maintenance and service

6 Variable speed ECM motors or direct-drive fans

- Greatly increases system reliability and efficiency eliminates belts and bearing setscrews
- Direct-drive fans eliminate belt maintenance
- Saves energy at light load
- Built-in inverter eliminates control panel heat
- Standard for both supply and exhaust fan

7 Multiple heat options

- Gas furnace with turndowns as high as 12.1
- Electric heat option with SCR for precise temperature control
- Hot water heat for boiler applications

Rebel® Chilled Water Air Handler—Features and Options

8 Double-wall foam cabinet

- Foam-injected panels with an R-value up to 13
- Increased insulation value for increased system efficiency
- Double-wall construction for increased indoor air quality
- No exposed insulation to the air stream
- Better thermal seal than fiberglass

9 Stainless steel, double sloped drain pan

- Prevents corrosion
- Avoids standing water for high IAQ

10 Low radiated noise

- Exellent acoustics at lower speeds

11 Economizer

- Provides free-cooling when outdoor conditions are suitable
- Provides fresh air to meet local requirements
- Integrated economizer operating with mechanical cooling
- Optional demand control ventilation for increased system efficiency

12 Outdoor air damper control

- Building pressure over-ride automatically opens dampers
- Monitor ensures precision airflow
- Efficient integrated operation with mechanical cooling
- Maintains ventilation with demand control

13 2" and 4" slide-out filter racks

- Easy filter changeouts for quick serviceability
- 2" MERV 8 filters are provided

14 Optional energy wheel

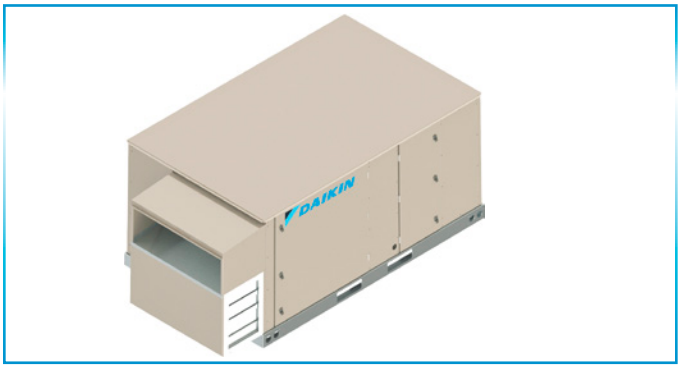
- Meets ASHRAE 90.1-2016 effectiveness requirements
- Factory installed and tested
- Single-point power
- Compact footprint
- Integrates with controls

Daikin Rebel chilled water air handler units are built to perform, with features and options that provide for lower installed and operating costs, superior indoor air quality, quiet operation and longevity.

Cabinet, Casing, and Frame

Panel construction includes double-wall with galvanized steel liner to enhance performance and satisfy IAQ requirements.

Figure 2: Durable, Double-wall Construction



- Heavy-duty lifting brackets are strategically placed for balanced cable or chain hook lifting
- Insulated floor panels have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance
- 2 part injected foam insulation have an R-value up to 13 for long equipment life and better acoustics
- Panel design includes no exposed insulation edges
- Unit cabinet can operate at total static pressures up to 5.0 inches of water
- Pre-painted galvanized steel exterior surfaces withstand a minimum 1000-hour salt spray as per ASTM B117 provides unit for long term durability
- Access doors include multiple, stainless steel hinges and ¼ turn latch system for easy access
- The unit base overhangs the roof curb for positive water runoff and seats on the roof curb gasket to provide a positive, weather tight seal

Indoor Coil

Indoor coil section is installed in a draw through configuration to provide better dehumidification.

- Chilled water cooling coils are fabricated of seamless muffled copper tubing that is mechanically expanded into enhanced plated pins for high efficiency
- Multi-row, staggered tube design coils with a minimum of 3 rows
- Each indoor air coil is completely piped to the through the base connection point and factory leak tested with high-pressure air
- Cooling coil is mounted in a stainless steel and positively sloped, ASHRAE 62.1 compliant, double sloped drain pan to improve IAQ

Variable Air Volume Control

MicroTech III proportionally controls the ECM motors or VFDs on the supply and exhaust fans, not only reduce fan energy and operating cost at part load conditions but also improves sound levels. Two supply fan control methods are offered:

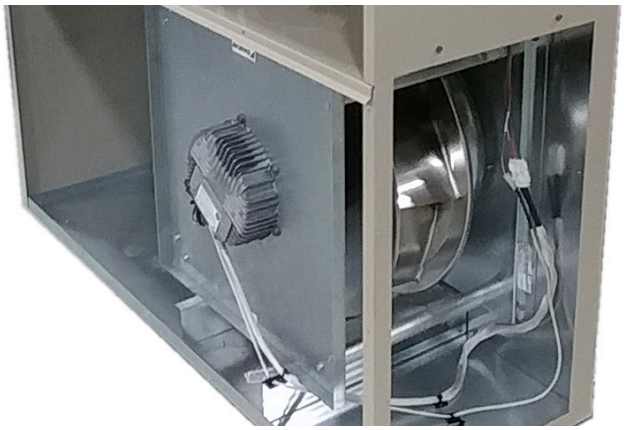
- Fan motor speed is controlled by the unit controller based on space temperature for singlezone VAV applications
- Fan motor speed is controlled by the unit controller based on a duct static pressure sensor for traditional VAV applications

Exhaust Fan

Single width, single inlet (SWSI) Class II airfoil fans with aluminum blades provide efficient and quiet operation at wide ranging static pressure and air flow requirements.

- Fan wheel is continuously welded to the hub plate and end rim for long lasting, reliable operation
- Direct drive fan with no belts, sheaves, or bearings and permanently lubricated motors provides low maintenance cost
- Each fan assembly is dynamically trim balanced at the factory before shipment for quick start up and efficient operation
- MicroTech III integrated controls modulate the totally enclosed EC premium efficiency motor for efficient part load control
- Motor with thermal overload and phase failure protection is are provided for motor long lasting operation

Figure 3: Exhaust Fan



Supply Fan

The airfoil single width, single inlet (SWSI) Class II construction supply fan with aluminum fan blades provides efficient and quiet operation at wide ranging static pressure and air flow requirements.

- Fan wheel is continuously welded to the hub plate and end rim for long lasting reliable operation
- Direct drive fan with no belts, sheaves, or bearings and permanently lubricated motors provide low maintenance cost
- Each fan assembly is dynamically trim balanced at the factory before shipment for quick start up and efficient operation
- MicroTech III integrated controls modulate the supply fan motor
- Motor with thermal overload and phase failure protection is provided for motor long lasting operation

Filters

Unit provides a draw-through filter section

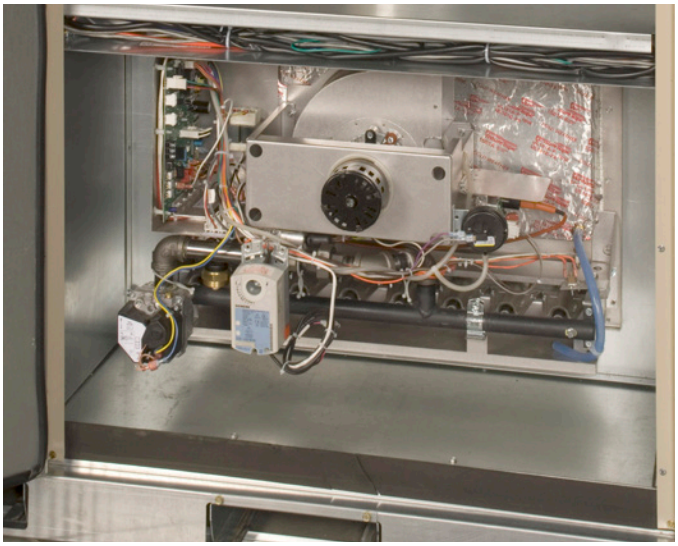
- Both 2" – 4" filter tracks are provided to accept a 2" pre filter and a 4"after filter. MERV 8 prefilters are provided
- The filter section includes hinged access door equipped with ¼ turn latch for easy access

Figure 4: Easy Access Filters

Heating Section

Wide ranging natural gas, electric, hot water heat selections effectively handle almost any heating demand from morning warm-up control to full heat.

Figure 5: Gas Furnace



Gas Furnace

ETL certified heating modules provide a custom match to specific design requirement.

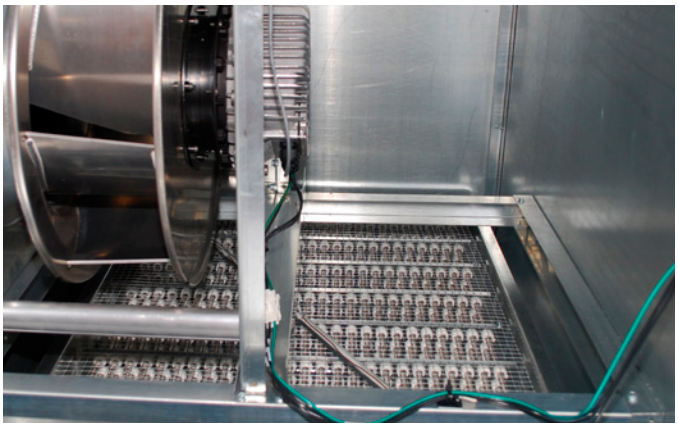
- Two stages, 5:1, 10:1, or 12:1 modulating heating control provides the flexibility to solve diverse needs
- All gas heat exchangers come with stainless steel to meet your application needs
- The furnace has a tubular design with in-shot gas burner manifold and is installed downstream of the supply fan
- The module contains an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases to protect indoor air quality
- Each burner module provides flame roll-out safety protection switches and a high temperature limit switch for reliable operation
- Induced draft fan includes an airflow safety switch to prevent heating operation in the event of no airflow for occupant safety
- All burner assemblies are factory tested and adjusted prior to shipment
- Heating control is fully integrated into the unit's MicroTech III control system for quick startup and reliable control
- Optional field installed LP kits are available for staged heating modules and some modulating burners

Electric Heat

ETL approved electric heat is factory assembled, installed and tested.

- Heating control is fully integrated into the unit's MicroTech III control system for quick startup and reliable control
- Multi-stage or SCR capability for application flexibility
- Durable low watt density, nickel chromium elements provide longer life
- Single point power connection reduces installation cost
- For operational safeties electric heat includes automatic reset, and high temperature limit safety protection and an airflow safety switch to prevent electric heat operation in the event of no airflow

Figure 6: Electric Heat Coils



Hot Water Coil

1, 2-row, and select 3-row high output options.

- Fully cased coil for better serviceability
- Factory installed coil vent and drain
- Piping vestibule for field installed piping control package
- Unit DDC control provides freeze protection and remote alarm signal
- DDC control ready with 2–10 volt wiring harness for field supplied and installed valve
- Each indoor air coil is factory leak tested with high-pressure air under water for reliable operation

Outdoor Air (OA) Monitor and Controller

Directly measures and controls outdoor ventilation air flow to improve indoor air quality (IAQ).

Model	Size (sq. ft.)	Min. CFM
Rebel DAH	3–5	100
	7–11	200
	15–21	400

Thermal dispersion technology, independently calibrated sensors using NIST traceable standards, and laboratory testing of the assembly allow ventilation control accuracy of +/- 15%.

This outdoor air monitor is ideal for low velocity ventilation control, sensitivity to air flow increases as flow rate decreases, and accuracy is a percent of reading. Competitive pitot tube and pressure drop alternatives have very little sensitivity at low velocities and accuracy is a percent of full scale readings.

Monitor and controller comply with the measurement portion of the Outdoor Air Delivery Monitoring LEED® Point EQc1.

This option is factory installed, calibrated and tested to reduce installation costs and risks. End-users only need to enter the outdoor air flow set point into the MicroTech III controller.

Figure 7: OA Monitor and Controller

OA Monitor

OA Controller

OA Monitor/Controller Application

The outdoor air monitor measures the airflow and sends the appropriate analog signal to the MicroTech III controller, which in turn modulates the outdoor air damper to maintain proper ventilation levels. The desired outdoor air flow set point is directly entered at the MicroTech III controller keypad or is read from the BAS.

Measured outdoor air CFM can be displayed on the MicroTech III controller, as well as the outdoor air monitor, and MicroTech III writes this value to the BAS.

All BAS communication is done through the optional, MicroTech III, LON®, or BACnet® communication cards.

The outdoor air monitor option is available on all economizer, 100% outdoor air, and energy recovery options as well as the 0-30% outdoor air option.

Control accuracy may exceed +/- 15% when the energy recovery wheel bypass dampers are open. This only occurs during economizer operation, at which time more than enough ventilation air is provided.

Outdoor/Return Air Section

Rebel units are available with a 0% to 30% outdoor air damper, a 0% to 100% economizer or also a 100% outdoor air option.

- Outside air intake hood constructed from painted galvanized steel for longer equipment life
- Outside air hood includes moisture eliminator filters to prevent water from entering the unit for better IAQ
- Vinyl gasketed, motorized blade dampers provides efficient operation by reducing leakage during OFF cycles

  Damper leakage is 1.5 cfm per square foot at 1" pressure. ASHRAE 90.1 minimum damper leakage is 267% greater than Rebel's damper leakage
- 0% to 30% damper is field adjusted to a fixed open position that is easily set using the MicroTech III keypad, allowing for a balance between IAQ and energy savings
- 0% to 100% option includes outside and return air dampers sized to handle 100% of the supply air volume for efficient and reliable operation
- 0% to 100%, fully functional, modulating economizer provides free cooling and reduces compressor energy and operating cost
- Economizer control is fully integrated into the unit's MicroTech III control system and features a spring-return actuator, adjustable minimum outside air set point and adjustable changeover
- Dry bulb or comparative enthalpy economizer changeover control is available to provide the most economical amount of outside air for "free" cooling
- Barometric relief dampers are standard for exhaust control and exhaust air out of the back of the unit and also include bird screen to prevent infiltration

Energy Recovery CORE®

CORE full enthalpy energy recovery heat exchangers recover 50% of both sensible and latent energy. Considerable energy savings can result:

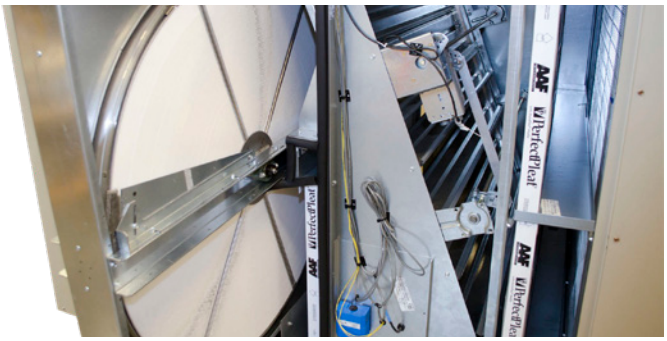
- Provide twice as much summer energy recovery as sensible-only alternatives such as run-around loops
- Less than 0.5% exhaust air transfer ratio (EATR) crossover
- Easily field cleanable with no mold or bacteria growth
- No moving parts for low lifetime maintenance
- MERV 8 prefilters provided on outdoor and return air paths to minimize dirt and cleaning

Energy Recovery Wheel

Daikin energy wheels normally recover 70-75% of both sensible and latent energy. Considerable energy savings can result:

- Provide twice as much summer energy recovery as sensible-only alternatives, such as run-around loops
- Energy recovery can increase the air conditioning capacity by 25% if the minimum outdoor air design is 33%. The cost savings on mechanical heating and cooling components offset the additional investment of energy recovery
- Winter humidification energy costs may be cut up to 60%
- Winter latent energy recovery lowers the dew point of exhaust air, compared to sensible-only alternatives, and allows frost-free operation to a lower ambient temperature
- Optional energy recovery wheel for increase efficiency for conditioning minimum outdoor air
- Unitary design for installation/rigging cost savings
- Single point power connection for decreased installation cost
- Slide-out wheel cassette & track for easy maintenance and cleaning
- Bypass dampers for increased efficiency during economizer operation
- Integrated unit control for control coordination between rooftop unit and wheel that controls the wheel speed
- Leaving wheel temperature sensors for wheel operation monitoring
- Integrated unit control with optimum leaving wheel temperature control to prevent over-heating the outdoor air
- Defrost options including ON/OFF control, Start/Stop and VFD speed modulation
- MERV 8 prefilters provided on outdoor and return air paths minimize dirt and cleaning

Figure 8: Energy Recovery Wheel



Electrical

Units are completely wired and tested at the factory to provide faster commissioning and start-up.

- Customer connection points comply with applicable NEC requirements
- Internal wiring adheres to all applicable third party (i.e. UL) standards
- For ease of use, wiring and electrical components are number coded and labeled according to the electrical diagram
- An optional 120 V GFCI convenience receptacle requiring independent power supply for the receptacle
- An optional unit powered 15 amp 120 V convenience receptacle, complete with factory mounted transformer, disconnect switch, and primary and secondary overload protection, eliminates the need to pull a separate 120 V power source
- A single point power connection with power block is standard and a terminal board is provided for connecting low voltage control wiring
- 120-volt control circuit transformer and fuse, system switches, and a high temperature sensor are for provided with the unit
- For better serviceability an optional non-fused disconnect switch is optionally mounted inside the control panel and operated by an externally mounted handle for disconnecting electrical power at the unit

Control Valve Options

Except for shut-off only packages, all valve and piping packages include control valves for controlling water flow. All Daikin control valves are factory assembled and mounted in the supply water pipe upstream of the coil. Several options are available:

2-Way Modulating Valves

These valves modulate the water flow through the coil in response to a signal from the MicroTech III controller. The actuator uses a 2 to 10 VDC proportional signal

3-Way Modulating Valves

These valves modulate the water flow through the coil in response to a signal from the MicroTech III controller. 3-way valves allow water that is directed through the coil to mix with water that is directed through the bypass line. This mixture exits through the leaving water pipe. The actuator uses a 2 to 10 VDC proportional signal.

Isolation Valves

These valves are available with and without the control valves. They are manual ball valves that provide the ability to isolate the water flow through the heating or cooling coil.

Daikin Rooftop units are intended for use in normal heating, ventilating, and air conditioning applications. Consult your local Daikin sales representative for applications involving operations at high ambient temperatures, high altitudes, non-cataloged voltages, or for job specific unit selections that fall outside of the range of the catalog tables.

For proper operation, units should be rigged in accordance with instructions stated in the Rebel Air Handler installation manual IM 1260). Fire dampers, if required, must be installed in the ductwork according to local and/or state codes. No space is allowed for these dampers in the unit. Follow factory check, test and start procedures explicitly to achieve satisfactory start-up and operation (see IM 1260). Most rooftop applications take advantage of the significant energy savings provided with economizer operation. When an economizer system is used, mechanical cooling is typically not required below an ambient temperature of 50°F.

Unit Location

The structural engineer must verify that the roof has adequate strength and ability to minimize deflection. Take extreme caution when using on a wooden roof structure. Unit condenser coils should be in a location that avoids any heated exhaust air.

Allow sufficient space around the unit for maintenance/ service clearance. Refer to Figure 9 on page 12 and page 13for recommended clearances. Consult your Daikin sales representative if available clearances do not meet minimum recommendations. Where code considerations, such as the NEC, require extended clearances, these take precedence.

Service Clearance

Allow for recommended service clearances as shown in Figure 9. Provide a roof walkway along the sides of the unit for service and access to controls and components. Contact your Daikin sales representative for service requirements less than those recommended.

Curb Installation

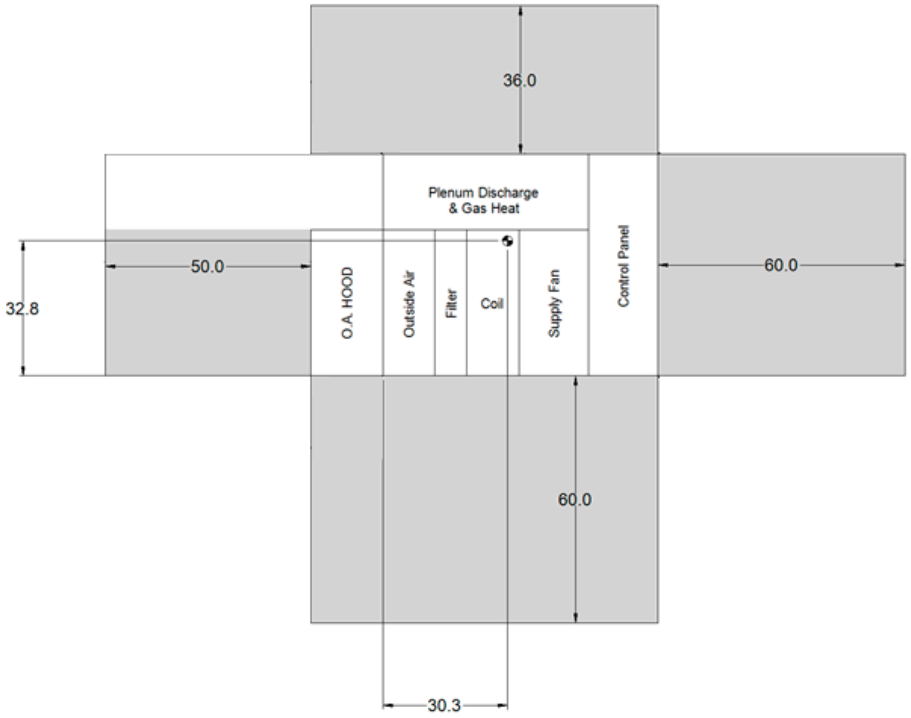
The roof curb is field-assembled and must be installed level (within 1/16" per foot side to side). A sub-base must be constructed by the contractor in applications involving pitched roofs. Gaskets are furnished and must be installed between the unit and curb. For proper installation, follow NRCA guidelines. Typical curb installation is illustrated in Figure 10 on page 14 through Figure 13 on page 17.

In applications requiring post and rail installation, an I-beam securely mounted on multiple posts should support the unit on each side. In addition, the insulation on the underside of the unit should be protected from the elements.

Applications in geographic areas subjected to seismic or hurricane conditions must meet code requirements for fastening the unit to the curb and the curb to the building structure.

Figure 9: Service Clearances

Small Cabinet
A03—A05



Medium Cabinet
A07—A11

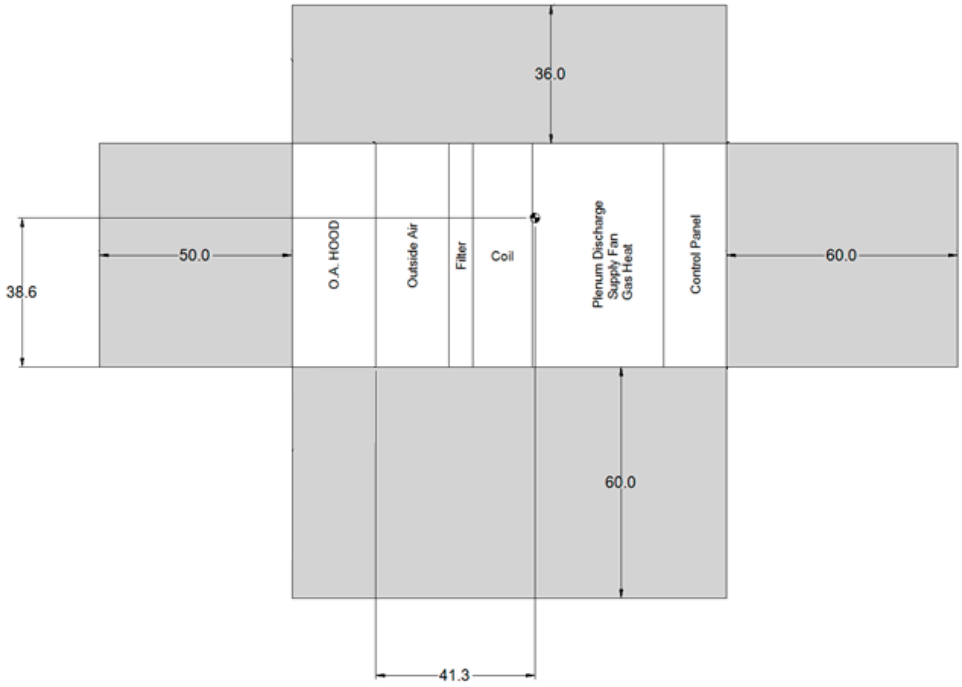
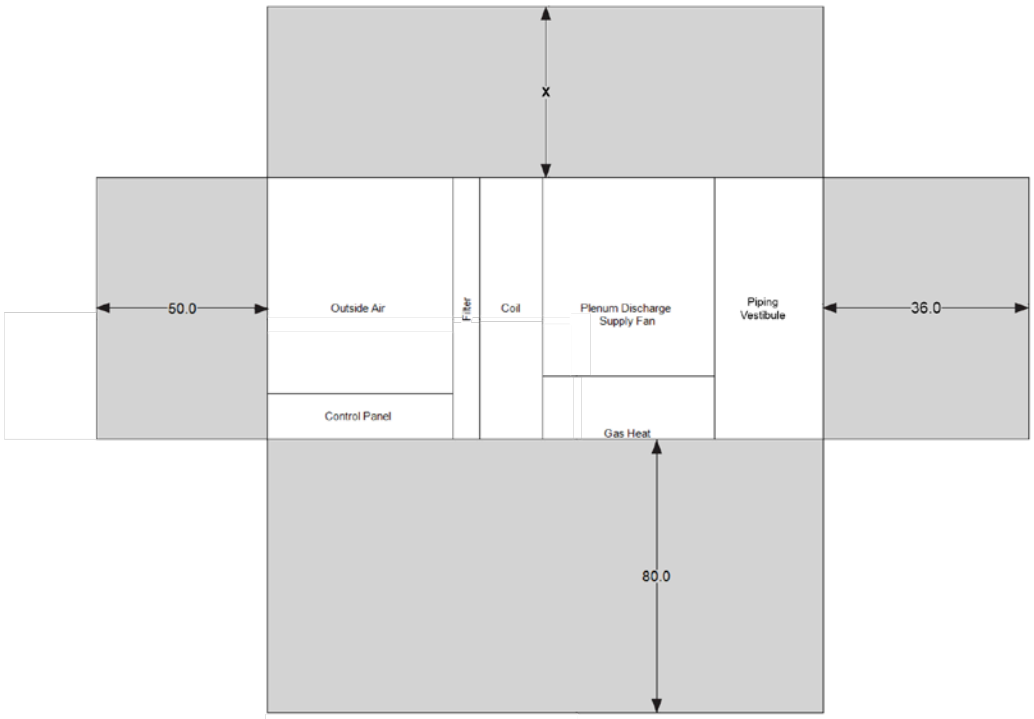


Figure 9 continued: Service Clearances

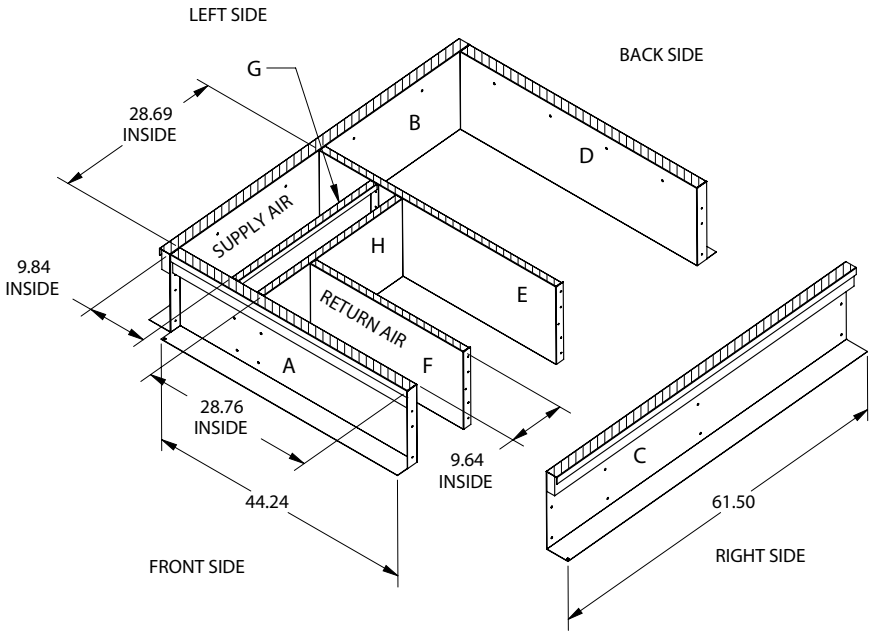
Large Cabinet
A15—A21



NOTES:

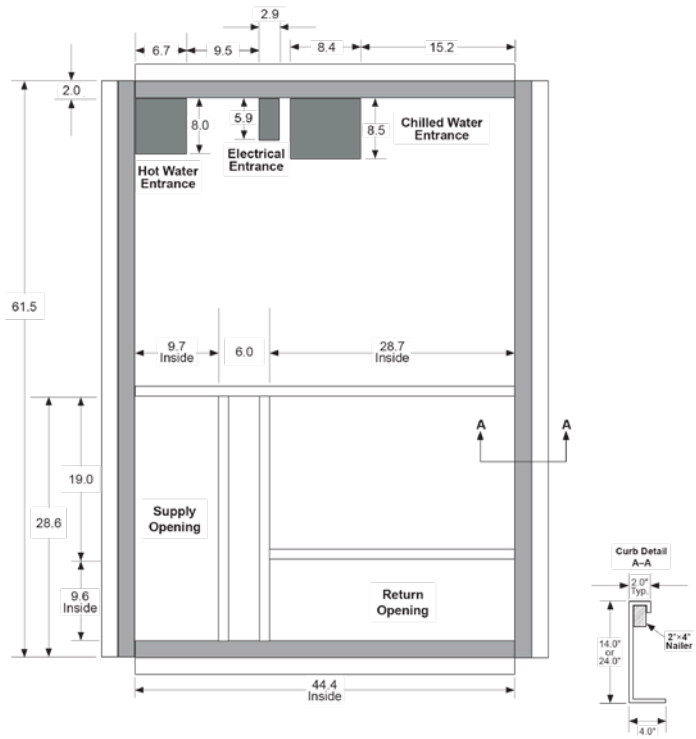
X = 60" with ERW, 36" without ERW

Figure 10: Roof Curb Assembly (DAH A03—A05)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Small Cabinet



Roof Curb for ERW – Small Cabinet

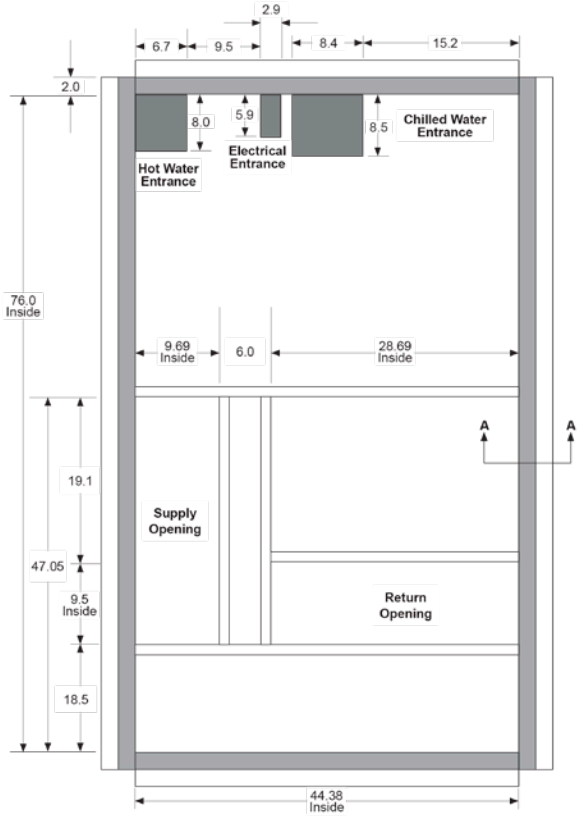
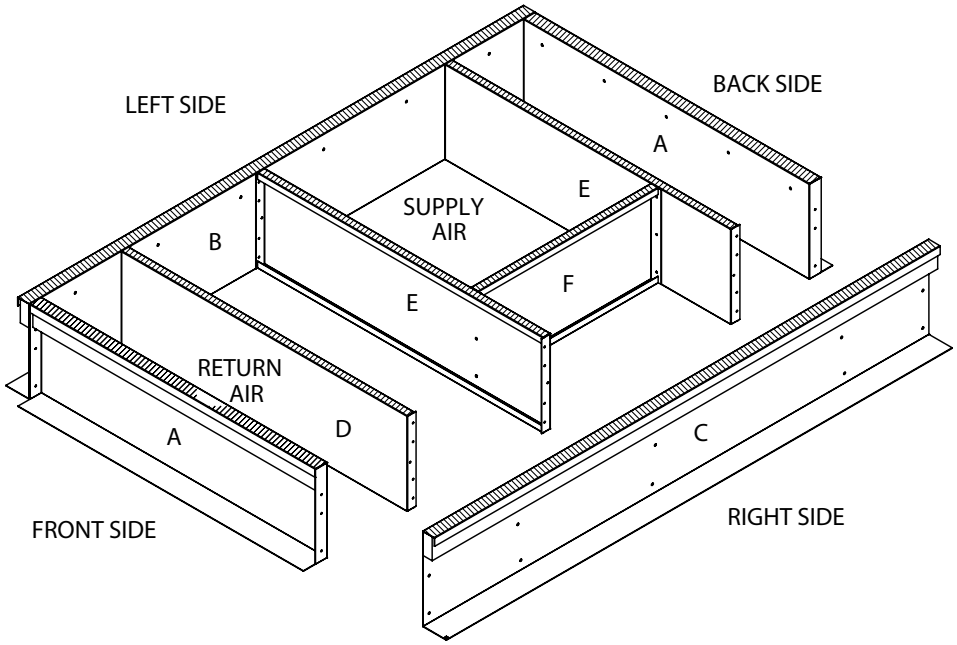
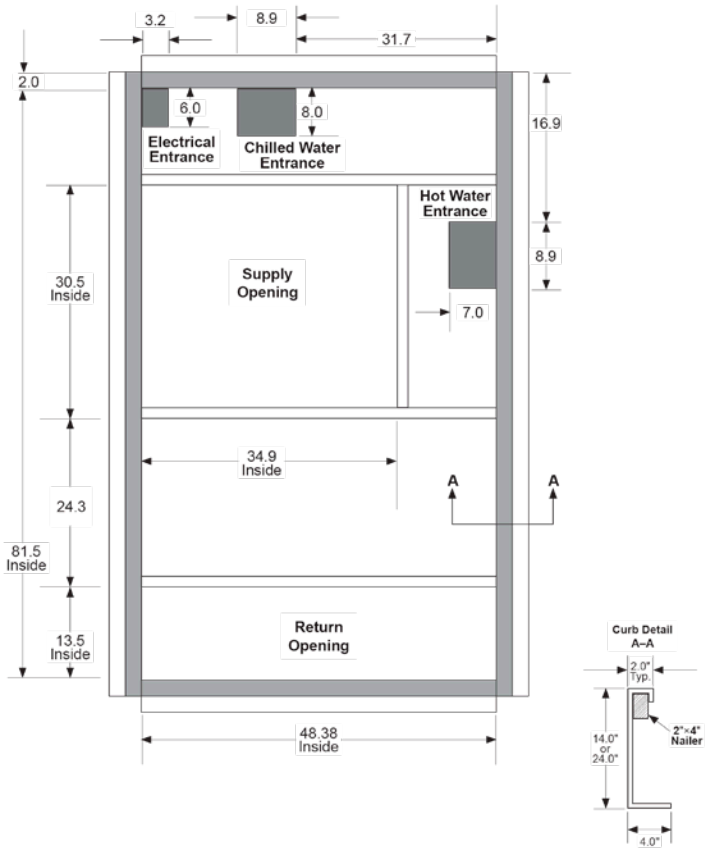


Figure 11: Roof Curb Assembly (DAH A07–A11)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Medium Cabinet



Roof Curb for ERW – Medium Cabinet

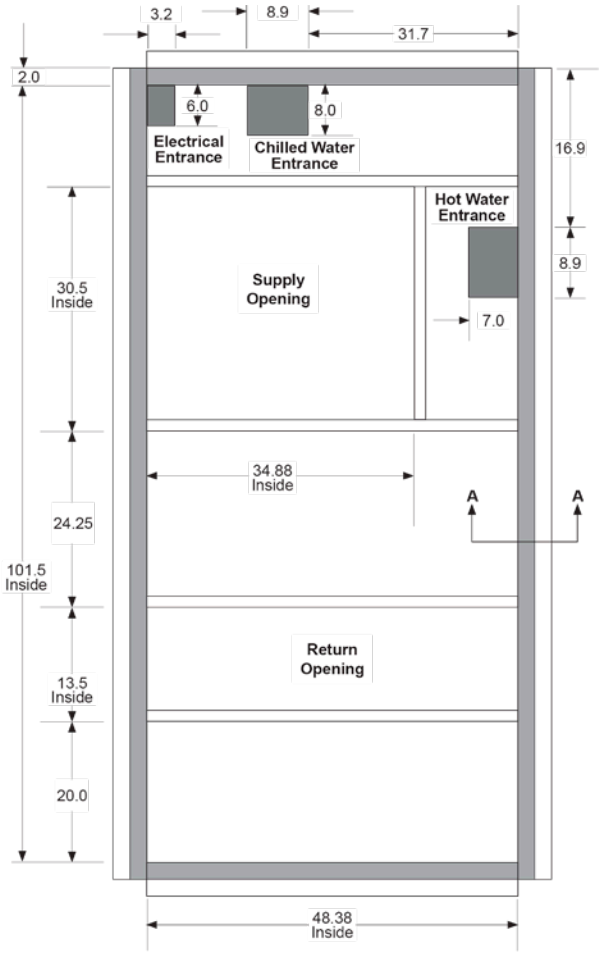
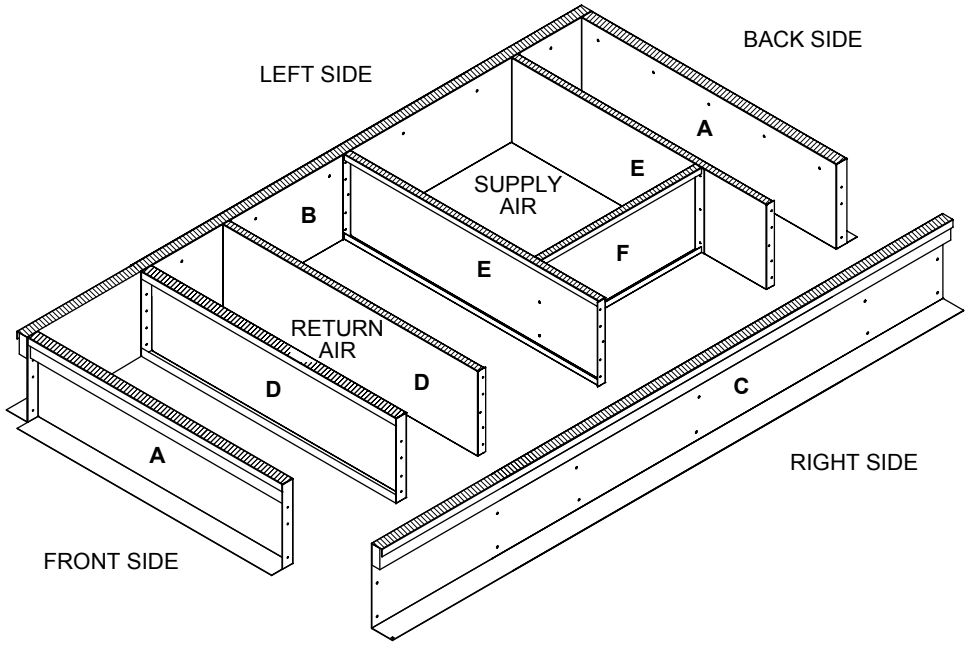
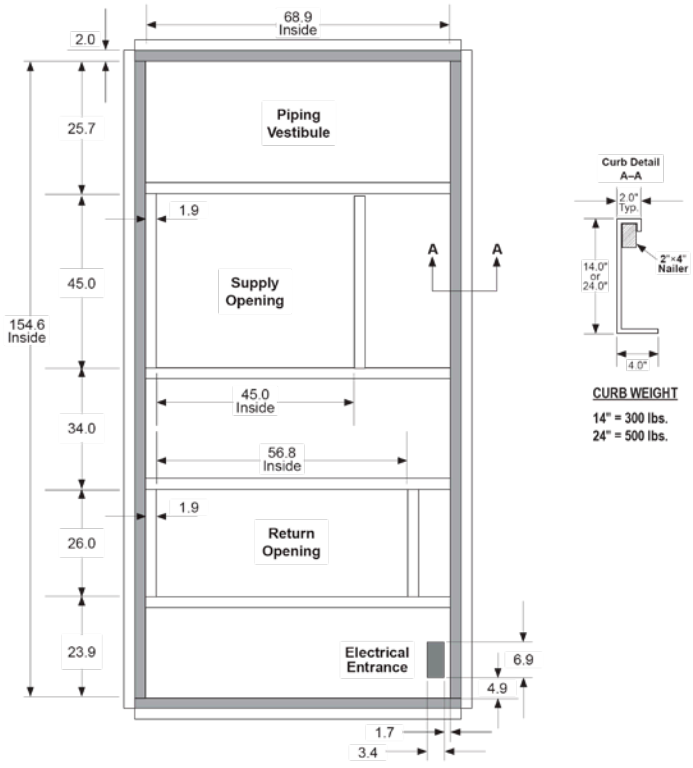


Figure 12: Roof Curb Assembly (DAH A15–A21)[1]



NOTE: 1. Check submittal drawing for gas/water/electrical/supply/return air opening
2. Horizontal above the roof gas connection only
3. All dimensions in inches

Standard Roof Curb – Large Cabinet



Roof Curb for ERW – Large Cabinet

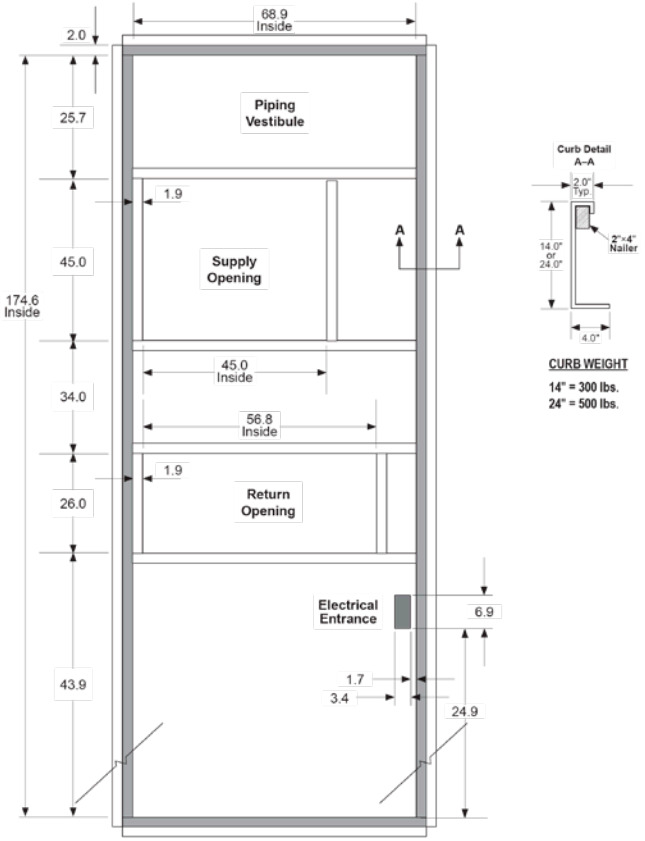
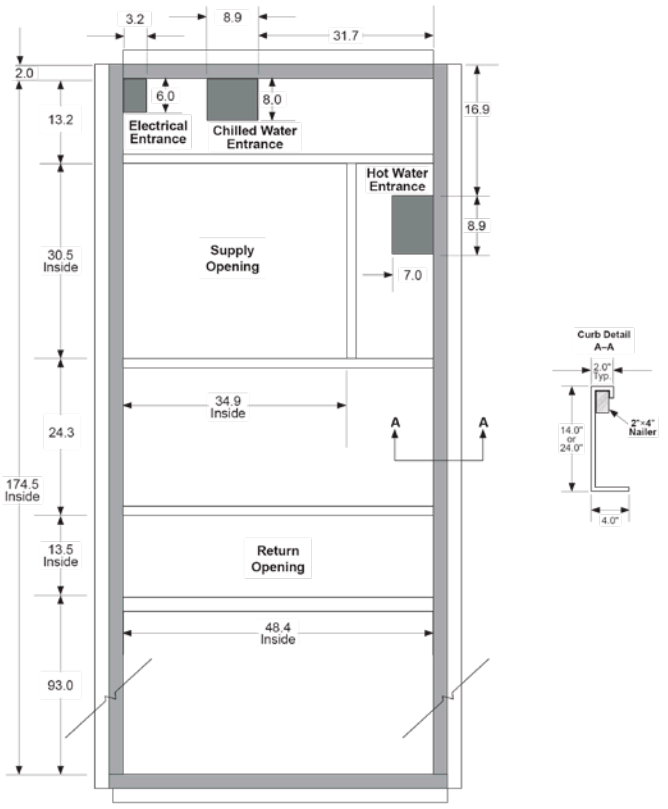
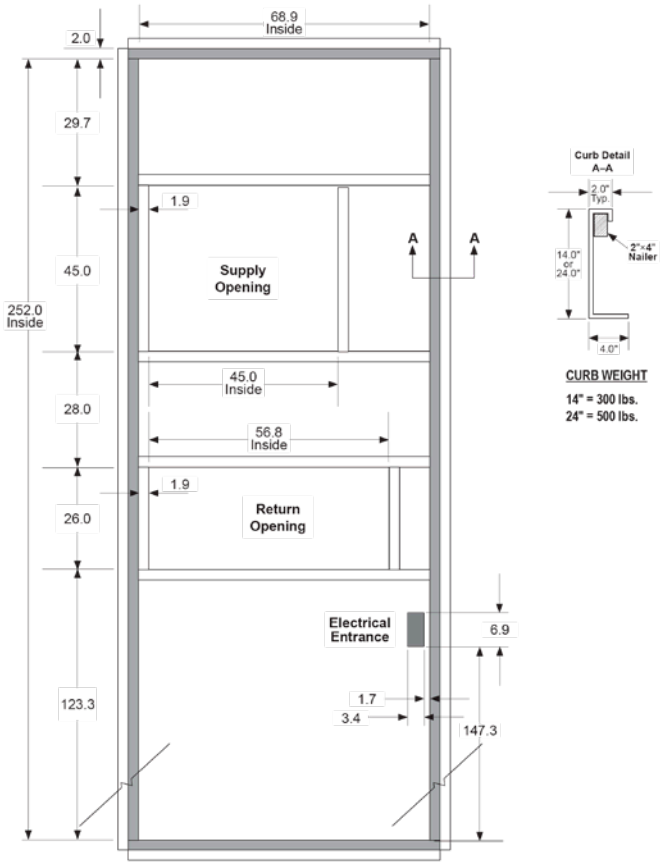


Figure 13: Roof Curb Assembly (DAH A07, A11, A15—A21) with CORE ERV

CORE Roof Curb – Medium Cabinet



CORE Roof Curb – Large Cabinet



Acoustical Considerations

Good acoustical design is critical for any installation and should start at the earliest stages in the design process. Common sound paths for rooftop equipment must be addressed are:

- Radiated sound through the bottom of the unit (air handling section and condensing section) and into the space
- Radiated sound to the property line
- Structure-borne vibration from the unit to the building
- Airborne sound through the supply air duct
- Airborne sound through the return air duct

Locating rooftop equipment away from sound sensitive areas is critical and the most cost effective means of avoiding sound problems. If possible, rooftop equipment should always be located over less sensitive areas such as corridors, toilet facilities or auxiliary spaces and away from office areas, conference rooms and classrooms. Some basic guidelines for good acoustical performance are:

- Provide proper structural support under all areas of the unit
- Always locate the unit's center of gravity close to a main support to minimize roof deflection
- Use a concrete deck or pad when a unit has to be located over an occupied space where good acoustics are essential
- Only the supply and return air ducts should penetrate the acoustical material and decking within the curb perimeter, and the openings must be sealed once the duct is installed
- Don't overlook the return air path. Never leave a clear "line of sight" into a return or exhaust fan; always include some duct work (acoustically lined tee) at the return inlet
- Place acoustical material in the area directly beneath the condensing section
- Select acoustical material that discourages microbial growth
- Minimize system static pressure losses to reduce fan sound generation
- Design duct systems to minimize turbulence
- Account for low frequency duct breakout in system design. Route the first 20 ft. of rectangular duct over non-sensitive areas and avoid large duct aspect ratios. Consider round or oval duct to reduce breakout

There are many sound sources in rooftop systems. Fans, compressors, condenser fans, duct take-offs, etc., all generate sound. For guidelines on reducing sound generation in the duct system, refer to the ASHRAE Applications Handbook. Contact your local Daikin sales representative for equipment supply, return and radiated sound power data specific to your application.

Ductwork Considerations

A well-designed duct system is required to allow the rooftop equipment to provide rated performance and to minimize system resistance and sound generation. Duct connections to and from units should allow straight, smooth airflow transitions. Avoid any abrupt change in duct size and sharp turns in the fan discharge. Avoid turns opposed to wheel rotation since they generate air turbulence and result in unwanted sound. If 90° turns are necessary, use turning vanes. Refer to the ASHRAE Applications Handbook for specific guidelines relevant to rooftop equipment.

Return Duct

The return path is the most often overlooked. A section of return duct is required to avoid a "line of sight" to the return air opening and to provide attenuation of return air sound. Install an insulated tee with a maximum duct velocity of 1000 to 1200 feet per minute. Extend the duct 15 feet to provide adequate attenuation.

Supply Duct

Insulate supply air ductwork for at least the first 20 feet from the unit. Consider the use of round or oval ductwork, as it significantly reduces low frequency breakout noise near the equipment. If rectangular duct is used, keep the aspect ratio of the duct as low as possible. The large flat surfaces associated with high aspect ratios increase low frequency breakout to the space and can generate noise, such as "oil canning." The maximum recommended supply duct velocity is 1800 to 2000 feet per minute.

Duct High Limit

A Daikin Packaged System with VAV control includes a duct high limit switch as a standard feature that is of particular importance when fast acting, normally-closed boxes are used.

Vibration Isolation

Make duct attachments to the unit with a flexible connection. Economizer and Exhaust Fan Application Rooftop economizer applications usually require exhaust fans to properly control building pressure and maintain minimum ventilation. The air balancer must adjust the outdoor air damper to provide minimum ventilation settings. The EAF is normally-off during non-economizer operation. During these minimum outdoor air conditions, the system essentially acts like a supply fan only system.

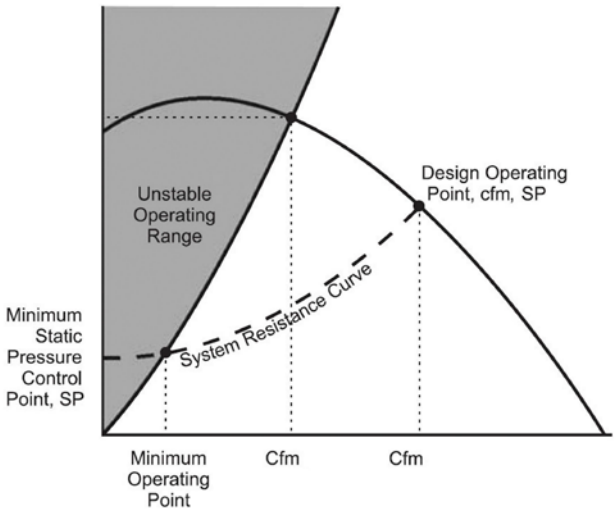
Smoke and Fire Protection

Due to the wide variation in building design and ambient operating conditions our units are applied, we do not represent or warrant that our products are fit and sufficient for smoke, fume, and fire control purposes. The owner and a fully qualified building designer are responsible for meeting all local and NFPA building code requirements with respect to smoke, fume, and fire control. The unit's control panel has a terminal block that a supply air and return air smoke detector can be wired to. An optional return air smoke detector is offered. Any other smoke detector, its installation, and the wiring to the unit controller are all field supplied.

Variable Air Volume Application

Rebel units include ECM supply and exhaust fans to provide variable air volume (VAV) control as shown in Figure 14. Daikin Rebel variable air volume systems (VAV) employ the concept of varying the air quantity to a space at a constant temperature, thereby balancing the heat gains or losses and maintaining the desired room temperature. This ability to reduce supply air quantities not only provides substantial fan energy savings at partial load conditions, but it also minimizes equipment sizing. Variable volume systems offer the following advantages:

Figure 14: Variable Air Volume (VAV) Control



- Lower system first cost by using system diversity to reduce equipment and duct sizes
- Lower operating costs by reducing fan energy demands, especially at part load conditions
- Provides excellent acoustics at lower air flows

In placing a duct static pressure sensor, locate a pressure tap near the end of the main duct trunk. Adjust the static pressure setpoint so that at minimum airflow all of the terminals receive the minimum static pressure required plus any downstream resistance. Locate the static pressure sensor tap in the ductwork in an area free from turbulence effects and at least ten duct diameters downstream and several duct diameters upstream from any major interference, including branch takeoffs.

Single Zone Variable Air Volume Application

A unit configured for single zone VAV will use discharge air control for mechanical cooling and heat, with VAV control of the supply air fan based upon the space or return air temperature. During cooling, the MicroTech III controller increases the ECM fan motor speed when the space temperature rises above the setpoint, and it decreases fan speed when space temperatures approach the setpoint. Mirror-image heating control is also provided. The MicroTech III controller will also use the control temperature to transition between cooling, fan only, and heating modes. Singlezone variable volume systems offer the following advantages:

- Lower system first cost
- Lower operating costs by reducing fan energy demands, especially at part load conditions
- Provides excellent acoustics at lower air flows

Fan Operating Range

The acceptable system operating range of the Daikin rooftop is determined by all of the following characteristics. Each of these limiting factors must be considered for proper performance and component design life:

- Unstable fan operation
- Maximum fan rpm
- Maximum cabinet static pressure
- Maximum face velocity (cooling coil is most important)
- Minimum furnace velocity
- Turndown capability on VAV applications
- Compressor operating pressures

Indoor Fan and Motor Heat

The indoor fan and motor electrical consumption is a sensible cooling load approximately equal to 2.8 MBh per bhp (depending slightly on motor efficiency). The fan and motor temperature rise is equal to Btuh/(1.08 × cfm) and is typically about 3°F.

Altitude Adjustments

Fan Curve Performance

Fan curve performance is based on 70°F air temperature and sea level elevation. Selections at any other conditions require adjustment for air densities listed in Table 1. Higher elevations generally require more rpm to provide a given static pressure but less bhp due to the decrease in air density.

Example:

Assume 2,000 cfm is required at 1.00" TSP. The elevation is 5000 ft. and 70°F average air temperature is selected. A 14" SWSI airfoil fan is selected.

1. The density adjustment factor for 5000 ft. and 70°F is 0.83.
2. TSP must be adjusted as follows:
   1.0" / 0.83 = 1.20".
3. Locate 2,000 cfm and 1.2 on the fan curve.
   Rpm = 1720 and bhp = 0.53.
4. Consumed fan power at design =
   0.53 bph × 0.83 = 0.44 bhp.

Table 1: Temperature and Altitude Conversion Factors

Air temp (°F)	Altitude (feet)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
-20	1.20	1.16	1.12	1.08	1.04	1.00	0.97	0.93	0.89
0	1.15	1.10	1.08	1.02	0.99	0.95	0.92	0.88	0.85
20	1.11	1.06	1.02	.098	0.95	0.92	0.88	0.85	0.82
40	1.06	1.02	0.98	0.94	0.91	0.88	0.84	0.81	0.78
60	1.02	0.98	0.94	0.91	0.88	0.85	0.81	0.79	0.76
70	1.00	0.96	0.93	0.89	0.86	0.83	0.80	0.77	0.74
80	0.98	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72
100	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.70
120	0.92	0.88	0.85	0.81	0.78	0.76	0.72	0.70	0.67
140	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.78	0.65

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Furnace Performance

Gas heat performance data is based on standard 70°F air temperature and zero feet altitude (sea level).

For altitudes between 2000 to 6000 feet, the gas burner must be derated 4% for every 1000 feet of altitude.

Example:

A 400 MBh furnace at an altitude of 3000 feet is derated (0.04 × 3 = 0.12). At 400 MBh input (400 × 0.12 MBh), the actual input is (400 - 48 = 352 MBh) at 3000 feet.

For altitudes above 6000 feet, consult the factory.

System Operating Limits

Daikin DAH systems are designed to operate over an extensive operating range. However, for proper system operation some limits do apply.

To help prevent moisture blow-off, design guidelines have been established for cooling coil selection. For applications outside of these limits, consult your Daikin sales representative.

In addition to maximum face velocity limitations, minimum velocity guidelines must also be followed. In order to maintain proper refrigeration performance, the minimum coil face velocity is 150 ft./min. When selecting a variable air volume unit, it is necessary to design the system such that the 150 ft./min. limit is maintained at light load conditions.

Condensate Drainage

Provide all drain pans with a properly sized p-trap to allow free drainage of coil condensate. For trap sizing, follow instruction given in the Rebel air handler installation manual. Run all traps and drain lines full size from the threaded unit connection to the roof drain.

Zone Sensor Placement

Placement of the zone temperature sensor is critical for proper and economical operation of the heating and cooling system. It is generally recommended that the space sensor be located on an inside wall (3 to 5 feet from an outside wall) in a space having a floor area of at least 400 square feet. Do not locate the sensor below the outlet of a supply diffuser, in the direct rays of the sun, on a wall adjacent to an unheated or abnormally warm room (boiler or incinerator room), or near any heat producing equipment. Where zone sensor placement is a problem, all zone control systems, as standard, have the capability to use a return air sensor for heating and cooling.

Unit Wiring

All units require three phase, 60 Hz, 208, 230, 460, and 575 volt power supply. All units include branch circuits and short circuit protection and are available with a power block or nonfused disconnect switch. Each unit is provided with a 120 V convenience outlet.

All wiring must be installed in accordance with the National Electric Code (NEC) and local codes.

Winter Shipment

Flat bed shipment in winter can expose units to harsh road chemicals. Since equipment size and configuration precludes covering during transit, wash units free of these chemicals as soon as possible to help prevent corrosion.

Coil Freeze Protection

When applying roof-mounted equipment in areas that experience subfreezing conditions, coil freeze protection measures must be provided. Subfreezing temperatures can adversely affect water and steam coils during controlled or uncontrolled unit shutdowns and even during unit operation. Daikin economizer dampers are arranged to direct the outside and return air streams toward each other, however, there may not always be a uniform unit temperature profile under all load and ambient temperatures. Some temperature stratification will occur, particularly at low ambient temperatures and the associated reduced airflow inherent with VAV systems.

Glycol is strongly recommended as a positive means of freeze protection for water coils. No control sequence can prevent coil freezing in the event of a power failure or equipment malfunction. During those periods, glycol is the only positive means of freeze protection. When selecting water coils, specify glycol to account for performance differences.

Parallel Air Paths on Energy Recovery Wheel Applications

Economizer Units

There are three sets or parallel air flow paths on economizer units:

Set 1: OA and RA paths to the SAF

- The OA path APD is normally greater than the RA path APD. Therefor, the air balancer must adjust the RA dampers to not open fully so that sufficient OA is achieved
- The RA path includes return duct ESP. Normally, the SAF handles both of these paths. Therefore, the EAF need not handle the return duct ESP. However:
  - The RA path is not open during economizer operation, so the EAF must handle return duct ESP during economizer operation or excessive positive building pressure will occur
- For VAV units, note that RA cfm during economizer operation normally is less that design return cfm
- An energy analysis must be careful not to overwhelm the EAF with return duct ESP except during economizer cooling

Set 2: OA wheel and OA bypass path to the SAF

Set 3: EA wheel and bypass path to the EAF

100% Outdoor Air Units

There are no parallel flow paths in a 100% OA unit. Instead, there is one counter-flow path (OA and EA paths throughout the wheel). The EAF must be sized for design return duct cfm and ESP as well as the wheel and wheel prefilter pressure drop.

Figure 15: Energy Wheel Parallel Air Path

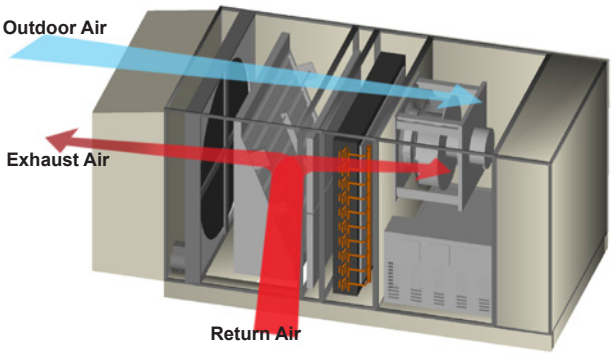


Table 2: Physical Data—Standard Units DAH A03 through A21

Model	Small Cabinet			Medium Cabinet			Large Cabinet		
	A03	A04	A05	A07	A09	A11	A15	A19	A21
Indoor Coil									
Rows / FPI	3/14, 5/12	3/14, 5/12	3/14, 5/12	3/14, 5/12	3/14, 5/12	3/14, 5/12	3/12, 5/12	3/12, 5/12	3/12, 5/12
Face area (sq ft)	3.2	4.1	5.0	7.0	9.0	11.1	15.1	18.9	21.4
Connection size (npt)	1-3/8"	1-3/8", 1-5/8"	1-5/8"	1-5/8"	2-1/8"	2-1/8"	2.0", 2-1/2"	2.0", 2-1/2"	2.0", 2-1/2"
Indoor Fan									
Type	Centrifugal Airfoil (SWSI)			Centrifugal Airfoil (SWSI)			Centrifugal Airfoil (SWSI)		
Quantity / Diameter	(1) 12", (1) 14", (1) 16"			(1) 12", (1) 14", (1) 16"			(1) 16", (1) 20", (1) 24"		
Drive type	Direct-Drive			Direct-Drive			Direct-Drive		
Motor HP range	1.3 / 2.3 / 4.0			2.3 / 4.0 / 8.0			2 – 20		
Filters									
Type	2", 4"			2", 4"			2", 4"		
Area (sq ft)	7.1			18			27		
Qty. - size	4 – 16 × 16			6 – 18 × 24			9 – 18 × 24		
Electric Heat Performance									
Control Options	2/4/SCR			4 stage/SCR			4 stage/SCR		
kW (low/ medium/high heat)[1]	6/12/18/30			18/36/54/72			10/20/30/45/60/72/90/120/150[1]		
Gas Heating Performance									
Input capacity (MBh)	80/120/160			200/300/400			300/450/600		
Number of stages (staged option)	2			2			4		
Turndown (Modulating options)	5:1			5:1, 10:1			12:01		
Gas connection size, mpt (quantity)	1/2" (1)			3/4" (1)			3/4" (2)		
Steady state efficiency	80%			80%			80%		
Hot Water Heating Coil									
Rows / FPI	2/10 or 1/8			2/10 or 1/8			3/13, 2/10, or 1/8		
Face area (sq ft)	2.5			5.4			12.3		
Connection size (sweat)[2]	1.130			1.375			1.625		

NOTE:

1. Some electric heat sizes not available in 208/230 Volt.
2. Connection sizes are for coil only.

Table 3: Physical Data—Unit Weights DAH A03 through A21

Model	Small Cabinet			Medium Cabinet			Large Cabinet		
	A03	A04	A05	A07	A09	A11	A15	A19	A21
Weight (lbs.)									
Base Weight[1]	600	620	640	975	1,000	1,050	2,050	2,113	2,150
High Capacity Coil[2]	15	18	22	23	37	44	97	120	134
Electric Heat	45			100			228		
Hot Water 1 Row	11			32			60		
Hot Water 2 Row	16			41			100		
Hot Water 3 Row	—			—			140		
Gas Heat	75			186			175/225/275		
Economizer	163			308			500		
Energy Recovery Weight Adds (lbs.)									
Wheel 100% OA	160			300			350		
Wheel Mixed Air	175			250			400		
CORE Recovery	—			1,450			2,260		

NOTE:

1. Includes standard cooling coil.
2. Dry coil weight

Table 4: Physical Data—Fan Weights DAH A03 through A21

Size A03–A11		Size A15–A21	
Indoor Fan Diameters	**Weights (lbs.)**	**Indoor Fan Diameters**	**Weights (lbs.)**
12 Inch (310 mm)	87	16 Inch (406 mm)	100
14 Inch (360 mm)	91	20 Inch (508 mm)	150
16 Inch (406 mm)	115	24 Inch (609 mm)	260
22 Inch (560 mm)	115	—	—

Table 5: Indoor Motor Weights

Indoor Motor (hp)	Weight (lbs.)
1	36
1.5	41
2	40
3	69
5	84
7.5	115
10	128
15	211
20	225

Table 6: Curb Weights (lbs.)

Unit Size	14"	24"
A03—A05	156	230
A07—A11	200	295
A15—A21	566	657

Fan Curves

Figure 16: Fan Curve – 12 inch Fan

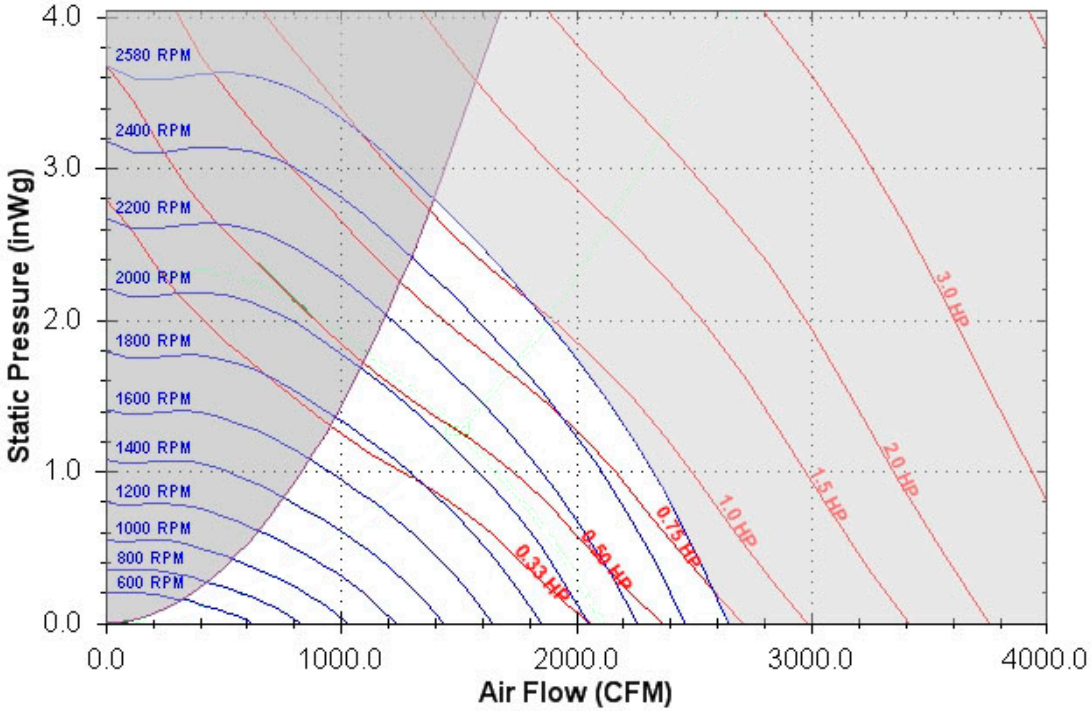


Figure 17: Fan Curve – 14 inch Fan

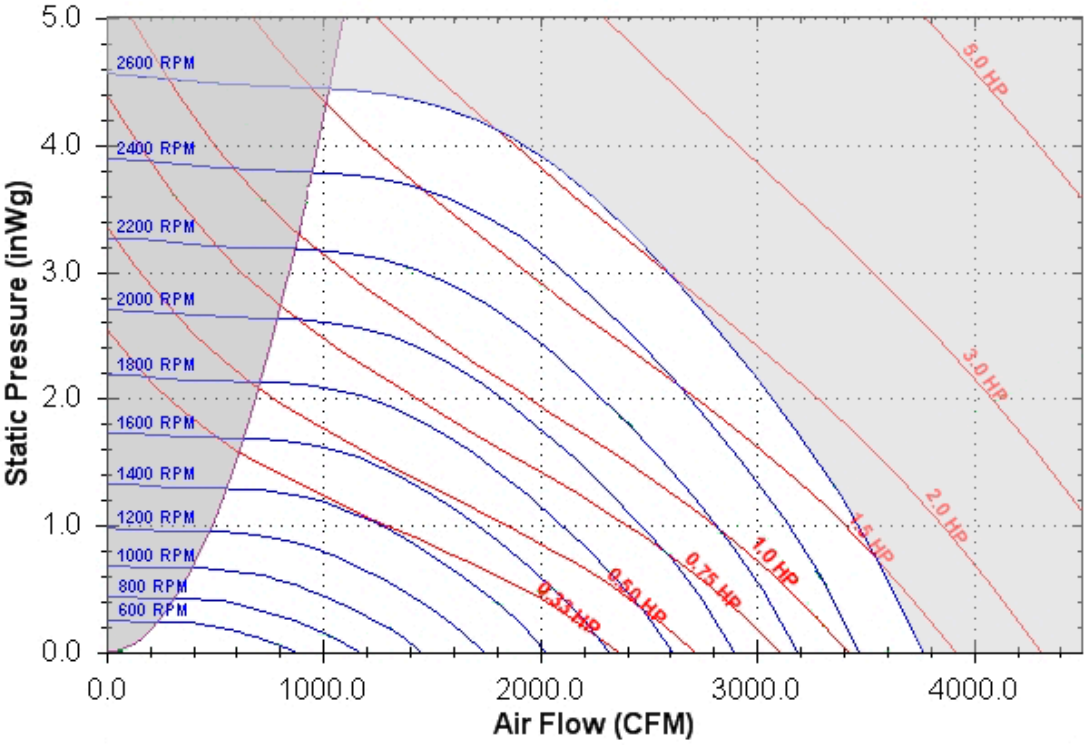


Figure 18: Fan Curve – 16 inch Fan

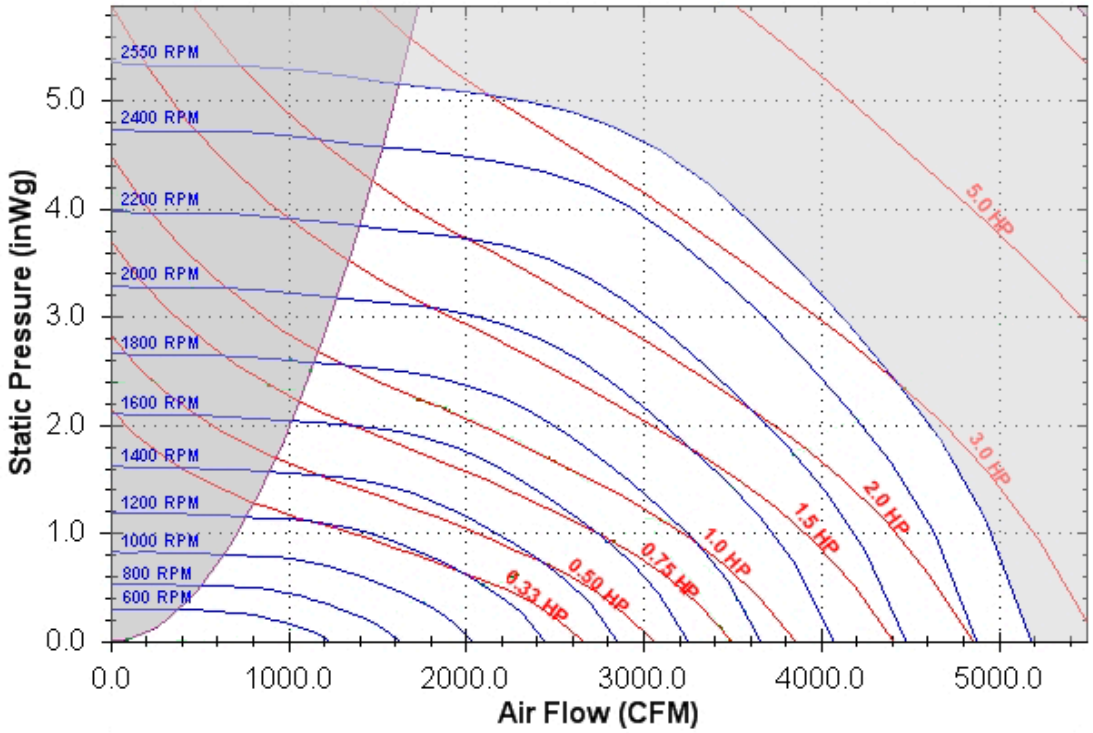


Figure 19: Fan Curve – 22 inch Fan

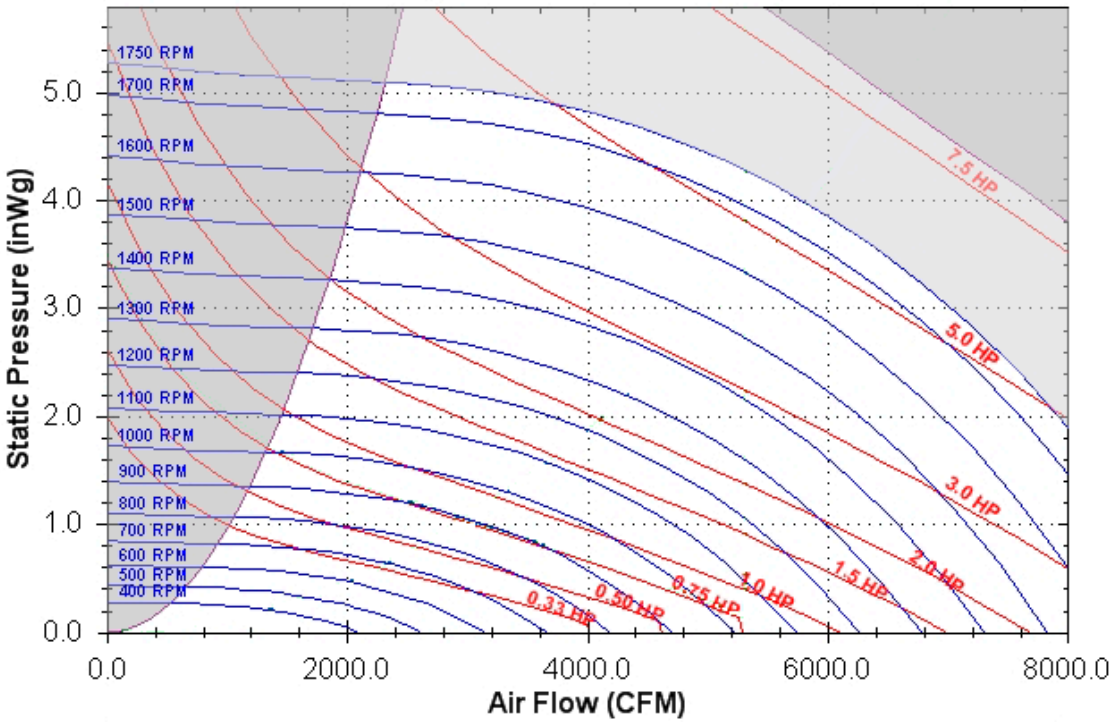


Figure 20: Fan Curve – DDPL-16 – Size 15–21

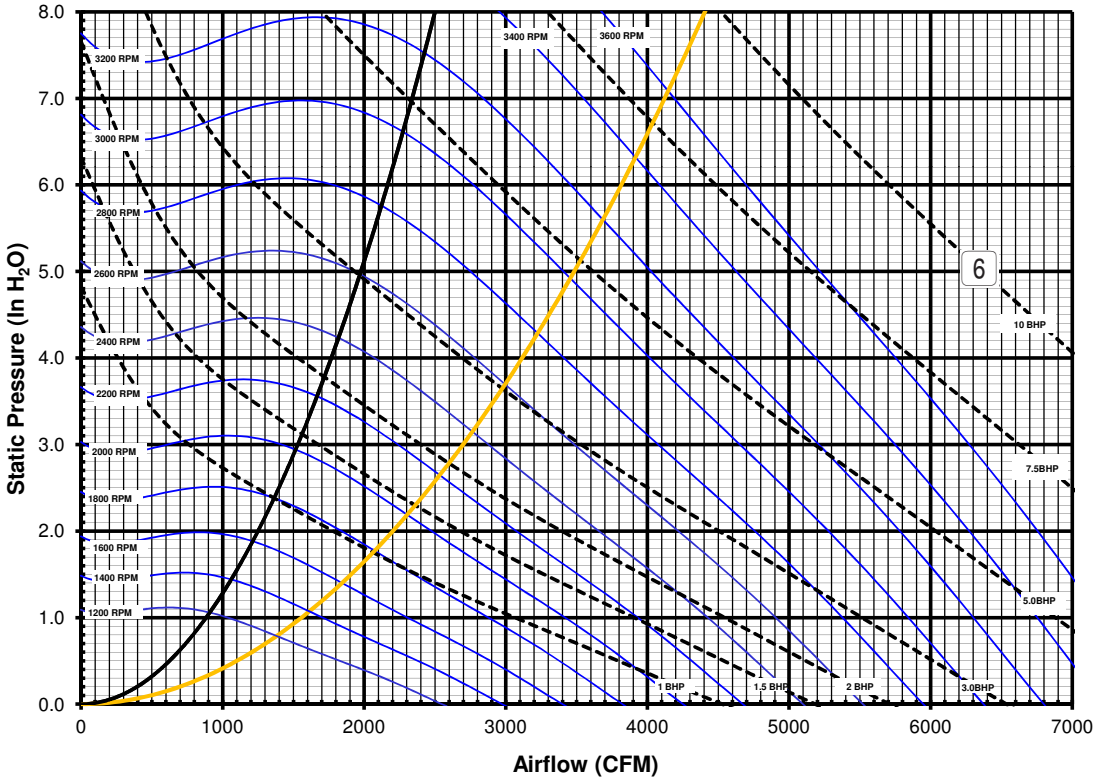


Figure 21: Fan Curve – DDPL-20 – Size 15–21

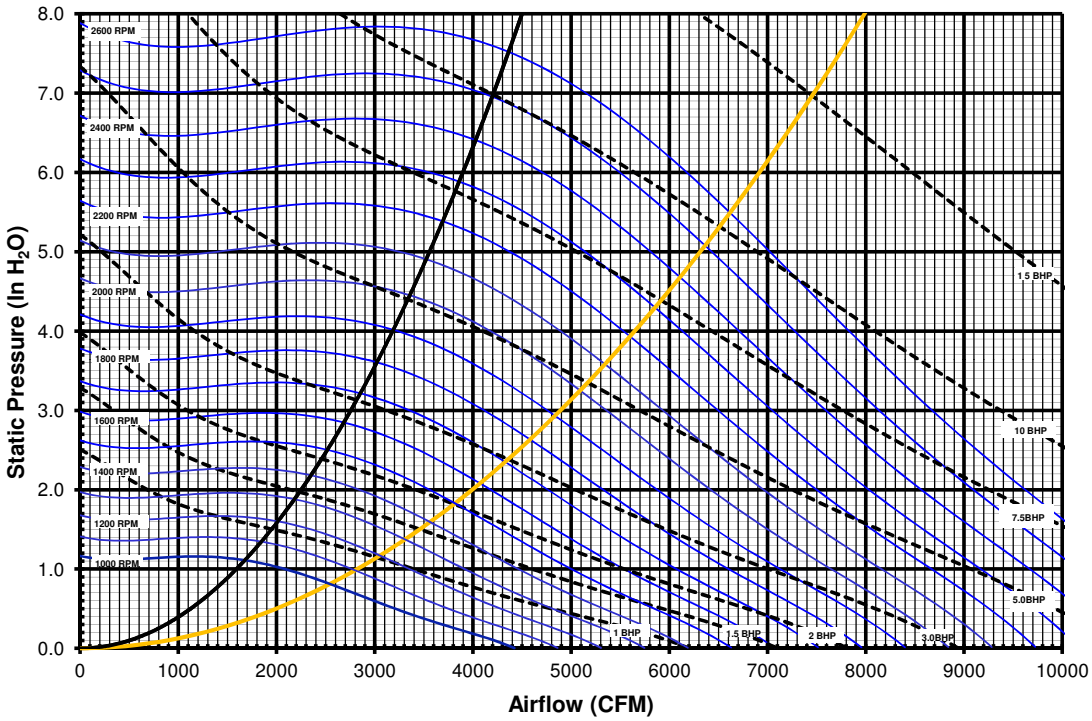
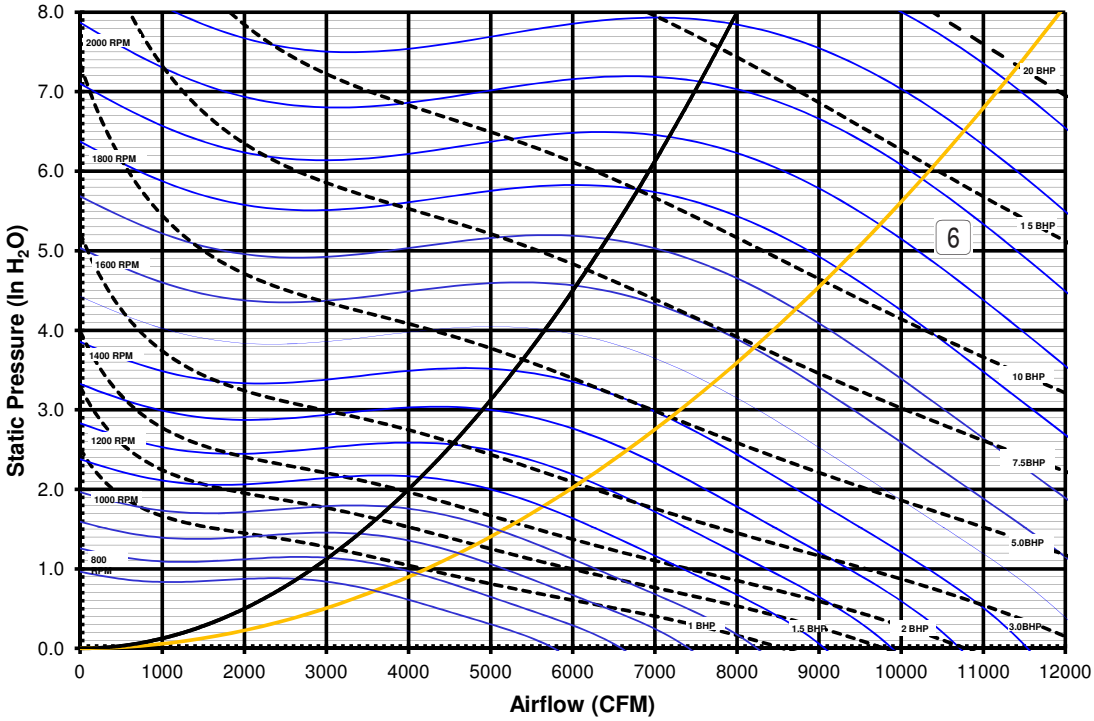


Figure 22: Fan Curve – DDPL-24 – Size 15–21



Heating Capacity

Table 7: Heating Capacity – Electric Heaters

Unit	Stages	Option #1				Option #2				Option #3				Option #4				Option #5				Option #6				Option #7				Option #8				Option #9			
		KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm	KW	MBH	Delta T[1]	Min cfm
A03	2, SCR	6	20.5	12.6	316	12	40.9	25.1	632	18	61.4	37.7	948	30	102.4	62.9	316	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
A04				9.4				18.8				28.3				47.2																					
A05				7.6				15.1				22.6				37.8																					
A07	2, SCR	18	61.4	16.2	948	36	122.8	32.3	1896	54	184.3	48.5	2844	72[2]	245.7	64.7	948	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
A09				12.6				25.2				37.7				50.3																					
A11				10.3				20.6				30.9				41.2																					
A15	4, SCR	10	34.1	4.2	— [4]	20	68.2	8.4	— [4]	30	102.4	12.6	1580	45	153.5	18.9	2369	60	204.7	25.2	3159	72	245.7	30.2	3774	90	307.1	37.7	4739	120[2]	409.5	50.3	6319	150[2]	511.8	62.9	7898
A19				3.3				6.6				9.9				14.9				19.9				23.8				29.8				39.7				49.7	
A21				3				6				9				13.5				18				21.6				27				35.9				44.9	

1. Temperature is calculated at nominal air flow.
2. Not available in 208 & 230 Volt.
3. 60 degree maximum rise.
4. Below fan turndown.

Table 8: Heating Capacity and Water Pressure Drop – Hot Water Coils

Unit	MBH	GPM	WPD
A03	61.4	6.1	1
A04	72.9	7.3	1.4
A05	91.6	9.2	2.2
A07	149.7	15	3.1
A09	176.9	17.8	4.2
A11	221.4	22.1	6.4
A15	149.7	15	3.1
A19	403	41.1	1.3
A21	497	50.7	1.6

Nominal airflow, 60°EAT, approximately 180°–160° water. WPD does not include a field supplied valve pressure drop. 2-row performance shown, 1-row coil also available.

Table 9: Heating Capacity – Gas Furnaces

Data	Unit Size								
	A03–A05			A07–A11			A15–A21		
	Low Heat	Med Heat	High Heat	Low Heat	Med Heat	High Heat	Low Heat	Med Heat	High Heat
Heating Input	50	100	150	200	300	400	300	450	600
Heating Output	40	80	120	160	240	320	240	360	480
Steady State Efficiency	80%								
Number of Stages	2			2			4		
Turndown[1]	5:01			5:1 or 10.1			12:1		

1. Modulating heat only.

Air Pressure Drops

Table 10: Pressure Drop – Electric Heaters, Vertical

Unit	Size	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
A03–A05	All	0.11	0.36	0.77	—	—	—	—	—
A07-A11	All	—	0.07	0.14	0.23	0.34	0.48	—	—
A15-A21	All	—	—	—	0.12	0.16	0.20	0.27	36

1. Refer to Daikin Sales Tools for unit specific pressure drop.

Table 11: Pressure Drop – Hot Water Coils, Vertical

Unit	Heat Type	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
A03–A05	Low (1 Row)	0.04	0.15	0.32	—	—	—	—	—
	High (2 Row)	0.11	0.37	0.83	—	—	—	—	—
A07–A11	Low (1 Row)	—	0.05	0.10	0.17	0.26	0.37	—	—
	High (2 Row)	—	0.11	0.23	0.39	0.59	0.83	—	—
A15–A21	Low (1 Row)	—	—	—	0.09	0.12	0.17	0.27	0.42
	Med (2 Row)	—	—	—	0.16	0.23	0.31	0.51	0.74
	High (3 Row)	—	—	—	0.25	0.37	0.50	0.80	1.16

1. Refer to Daikin Sales Tools for unit specific pressure drop.

Table 12: Pressure Drop – Gas Furnaces, Vertical

Unit	Heat Type	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
A03–A05	Low(50 MBH)	0.08	0.33	0.74	—	—	—	—	—
	Med(100 MBH)								
	High (150 MBH)								
A07–A11	Low (200 MBH)	0.02	0.07	0.14	0.23	0.35	0.49	—	—
	Med (300 MBH)								
	High (400 MBH)								
A15–A21 1	Low (300 MBH)	—	—	—	0.10	0.12	0.23	0.42	0.65
	Med (450 MBH)								
	High (600 MBH)								

1. Vertical discharge calculation.
2. Refer to Daikin Sales Tools for unit specific pressure drop.

Table 13: Pressure Drop – Components

Component	Unit	Unit Airflow							
		1000	2000	3000	4000	5000	6000	8000	10000
Economizer									
	A03–A05	0.01	0.05	—	—	—	—	—	—
	A07–A11	—	0.03	0.08	0.13	0.20	—	—	—
	A15–A21	—	—	—	0.08	0.12	0.18	0.31	0.49
Filter									
	A03–A05	0.03	0.12	—	—	—	—	—	—
	A07–A11	—	0.02	0.06	0.09	0.15	—	—	—
	A15–A21	—	—	—	0.11	0.13	0.19	0.27	0.38
Standard Cooling Coil									
	A03	0.38	—	—	—	—	—	—	—
	A04	0.26	0.73	—	—	—	—	—	—
	A05	0.19	0.54	—	—	—	—	—	—
	A07	—	0.33	0.60	—	—	—	—	—
	A09	—	0.22	0.41	0.63	—	—	—	—
	A11	—	0.16	0.30	0.46	0.64	—	—	—
	A15	—	—	—	0.26	0.36	0.48	0.74	—
	A19	—	—	—	0.18	0.26	0.34	0.53	0.74
	A21	—	—	—	—	0.21	0.28	0.44	0.61
High Capacity Cooling Coil									
	A03	0.53	—	—	—	—	—	—	—
	A04	0.36	1.04	—	—	—	—	—	—
	A05	0.26	0.77	—	—	—	—	—	—
	A07	—	0.46	0.85	—	—	—	—	—
	A09	—	0.31	0.57	0.89	—	—	—	—
	A11	—	0.22	0.42	0.65	0.91	—	—	—
	A15	—	—	—	0.43	0.6	0.8	1.23	—
	A19	—	—	—	0.31	0.43	0.57	0.88	1.23
	A21	—	—	—	—	0.36	0.47	0.73	1.02

1. Refer to Daikin Sales Tools for unit specific pressure drop.

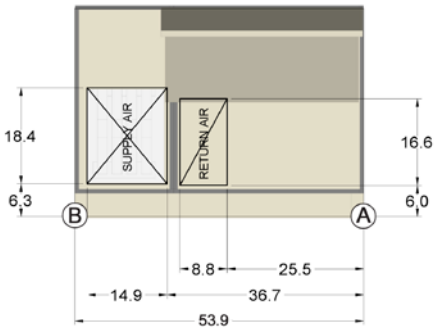
Table 14: Pressure Drop — Energy Recovery Wheel

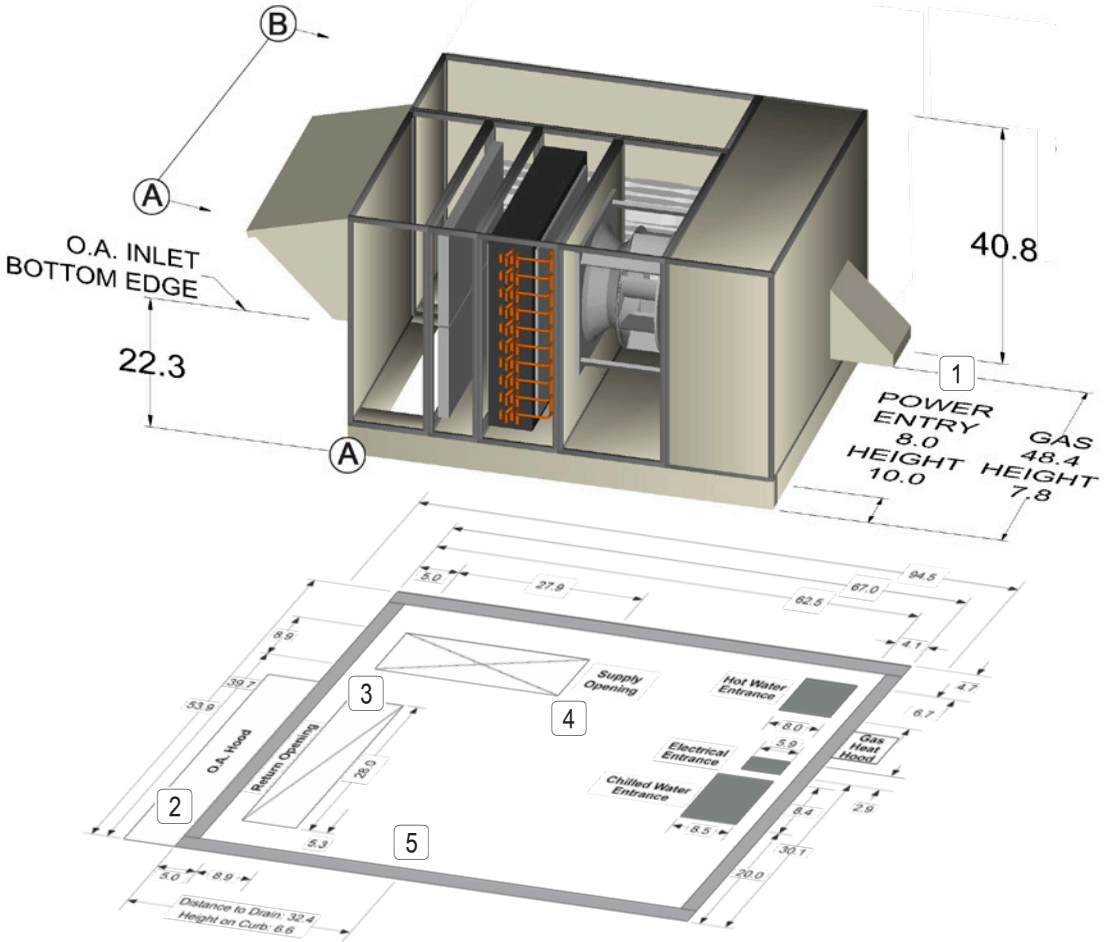
	Airflow (CFM)														
	500	750	1000	1250	1500	2000	2500	2800	3000	3500	4000	4500	5000	5500	6500
Unit A03 through A05															
Wheel and Prefilters	0.38	0.56	0.74	0.92	1.09	—	—	—	—	—	—	—	—	—	—
Unit A07 through A11															
Low Airflow Wheel and Prefilters	—	0.34	0.44	0.54	0.64	0.84	1.05	1.17	—	—	—	—	—	—	—
High Airflow Wheel and Prefilters	—	—	—	0.29	0.35	0.45	0.56	0.63	0.67	0.78	0.89	0.99	1.1	—	—
Unit A15 through A21															
Low Airflow Wheel and Prefilters	—	—	—	—	0.52	—	0.88	—	—	1.26	—	—	—	—	—
High Airflow Wheel and Prefilters	—	—	—	—	0.3	—	0.5	—	—	0.71	—	0.92	—	1.14	1.35

1. Refer to Daikin Sales Tools for unit specific pressure drop.

Figure 23: DAH A03–A05, No Energy Recovery, 0–30% or 100% Outdoor Air

Detail: A-B Optional Horizontal Supply and Return Air Openings

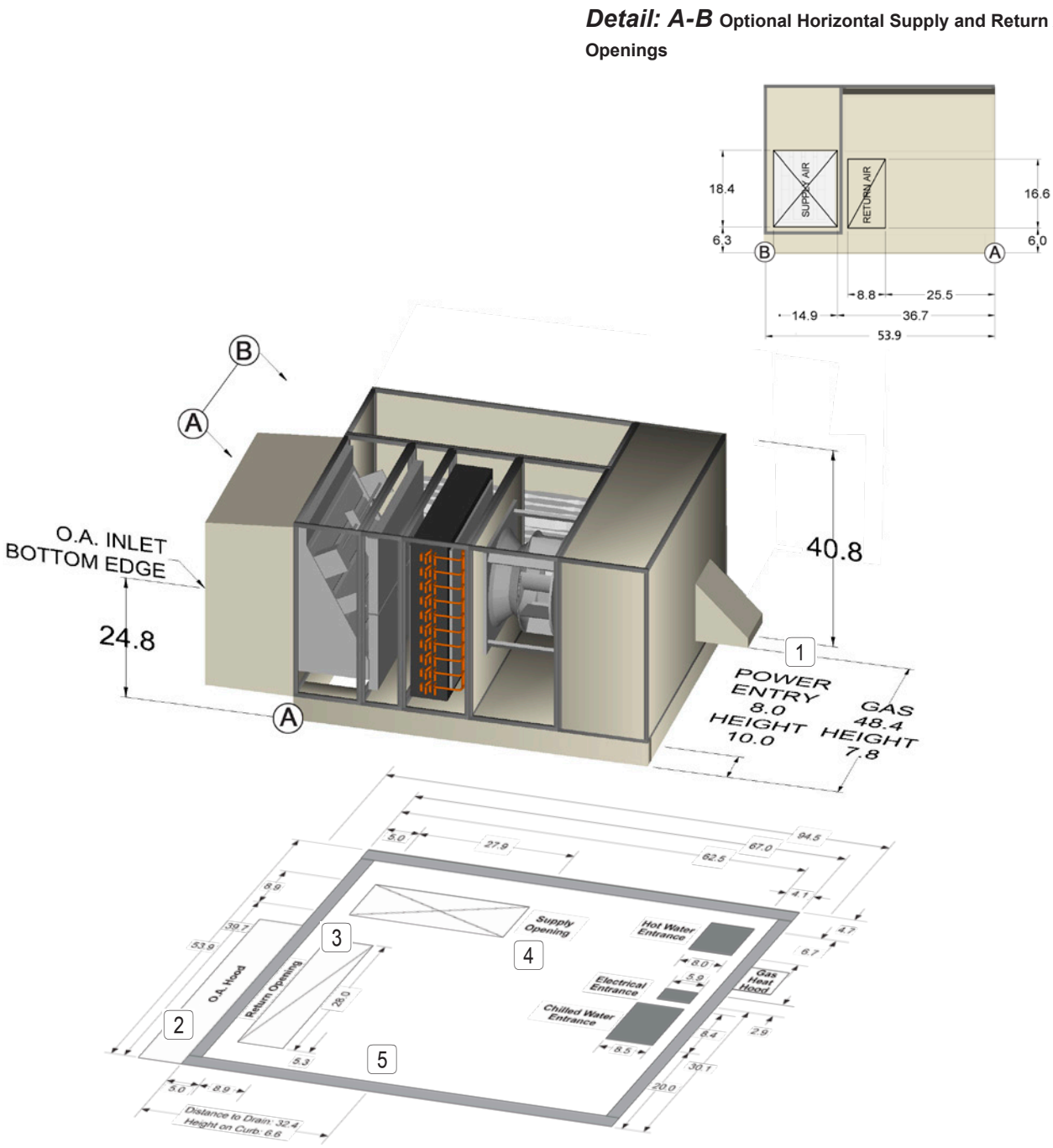




NOTE: Horizontal above the roof gas connection only

1. Recommended location for field cut side power connection
2. Not provided on 100% Return Air units
3. Not provided on 100% Outdoor Air units
4. Not provided on units with Horizontal Supply Air opening
5. Not provided on units with Horizontal Return Air opening
6. Exhaust fan not available with Horizontal Return Air opening

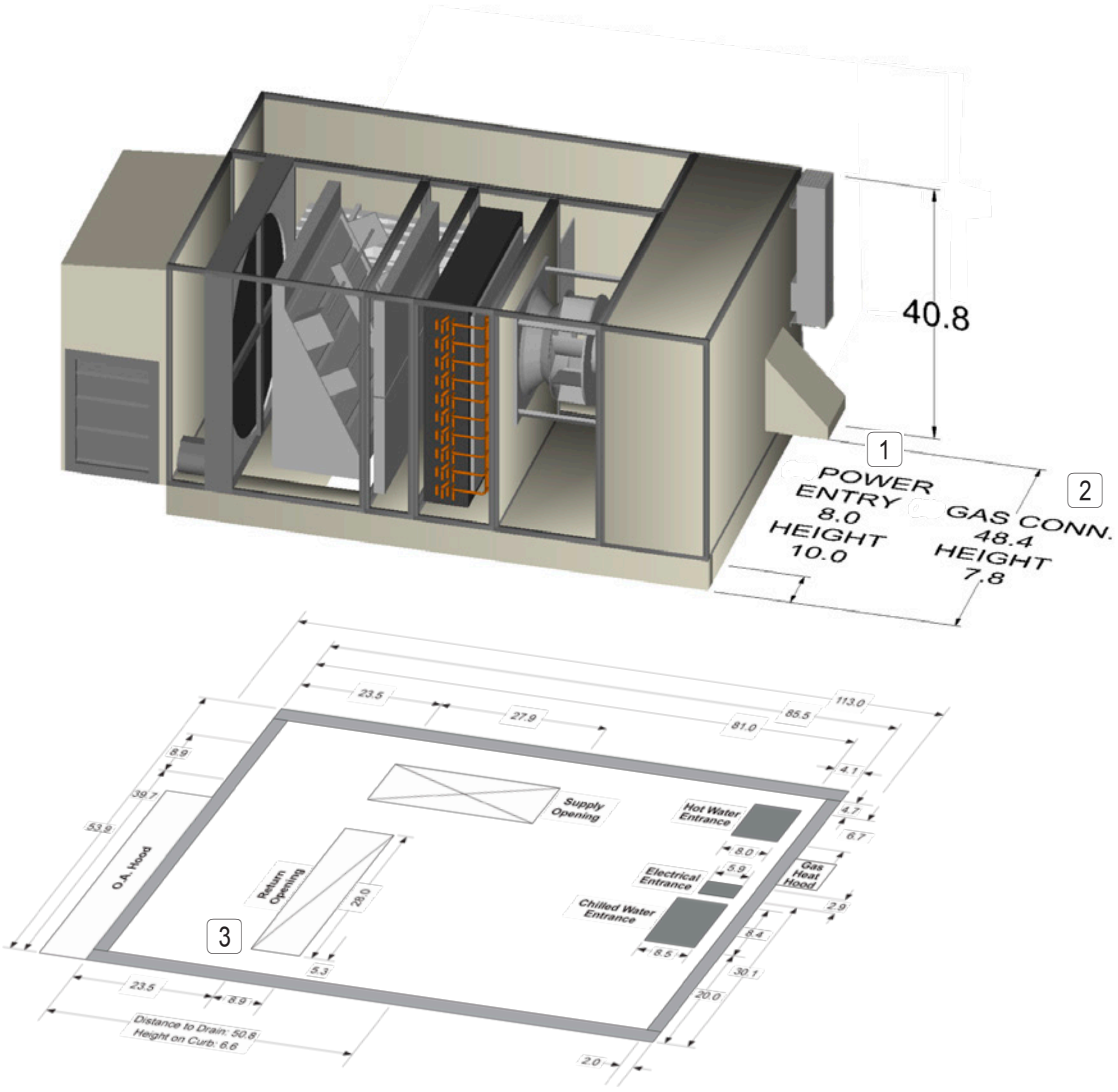
Figure 24: DAH A03–A05, Economizer, No Energy Recovery



NOTE: Horizontal above the roof gas connection only

1. Recommended location for field cut side power connection
2. Not provided on 100% Return Air units
3. Not provided on 100% Outdoor Air units
4. Not provided on units with Horizontal Supply Air opening
5. Not provided on units with Horizontal Return Air opening
6. Exhaust fan not available with Horizontal Return Air opening

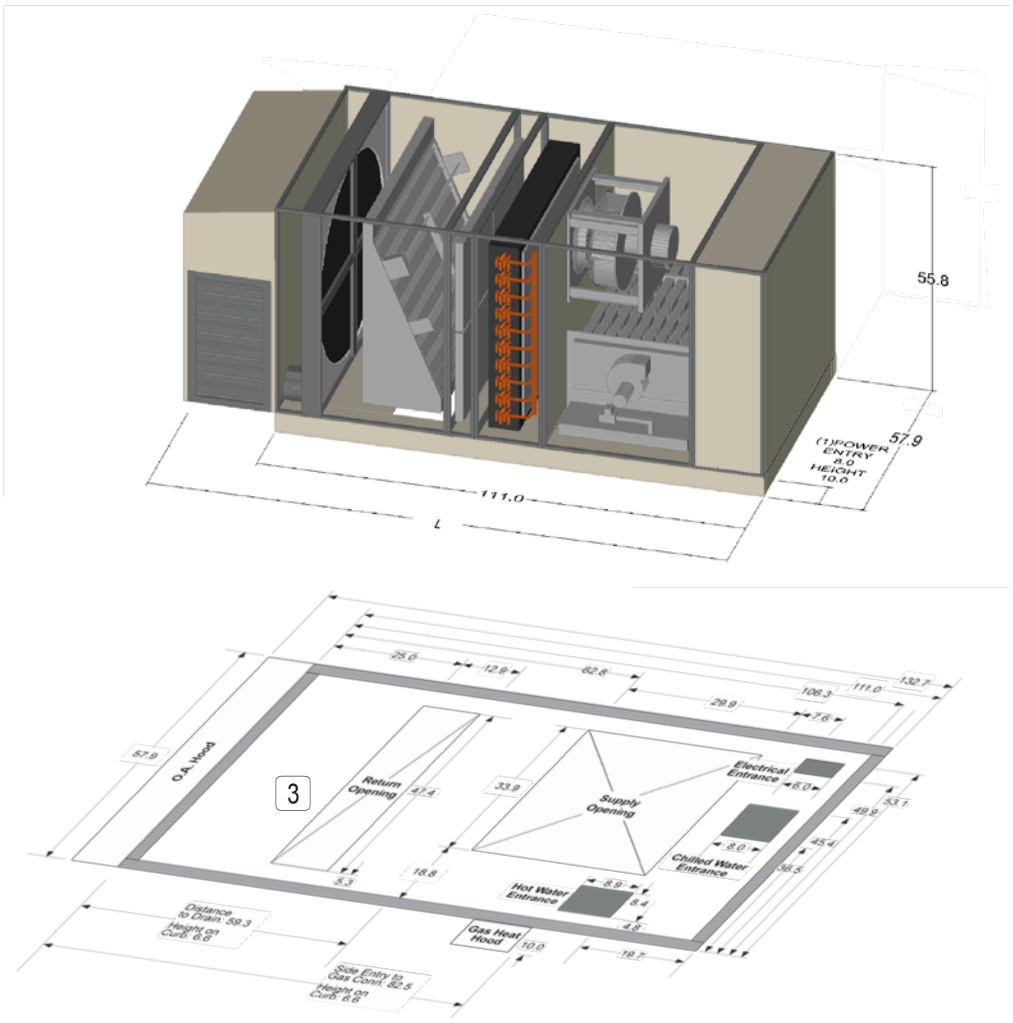
Figure 25: DAH A03–A05, Energy Recovery, All Outdoor Air Options



NOTE: 1. Recommended location for field cut side power connection
2. Horizontal gas connection only. Gas pipe routing within roof curb is not available
3. Not supplied on 100% OA units
4. Not available with horizontal return

Figure 26: DAH A07–A11, Energy Recovery, All Outdoor Air Options

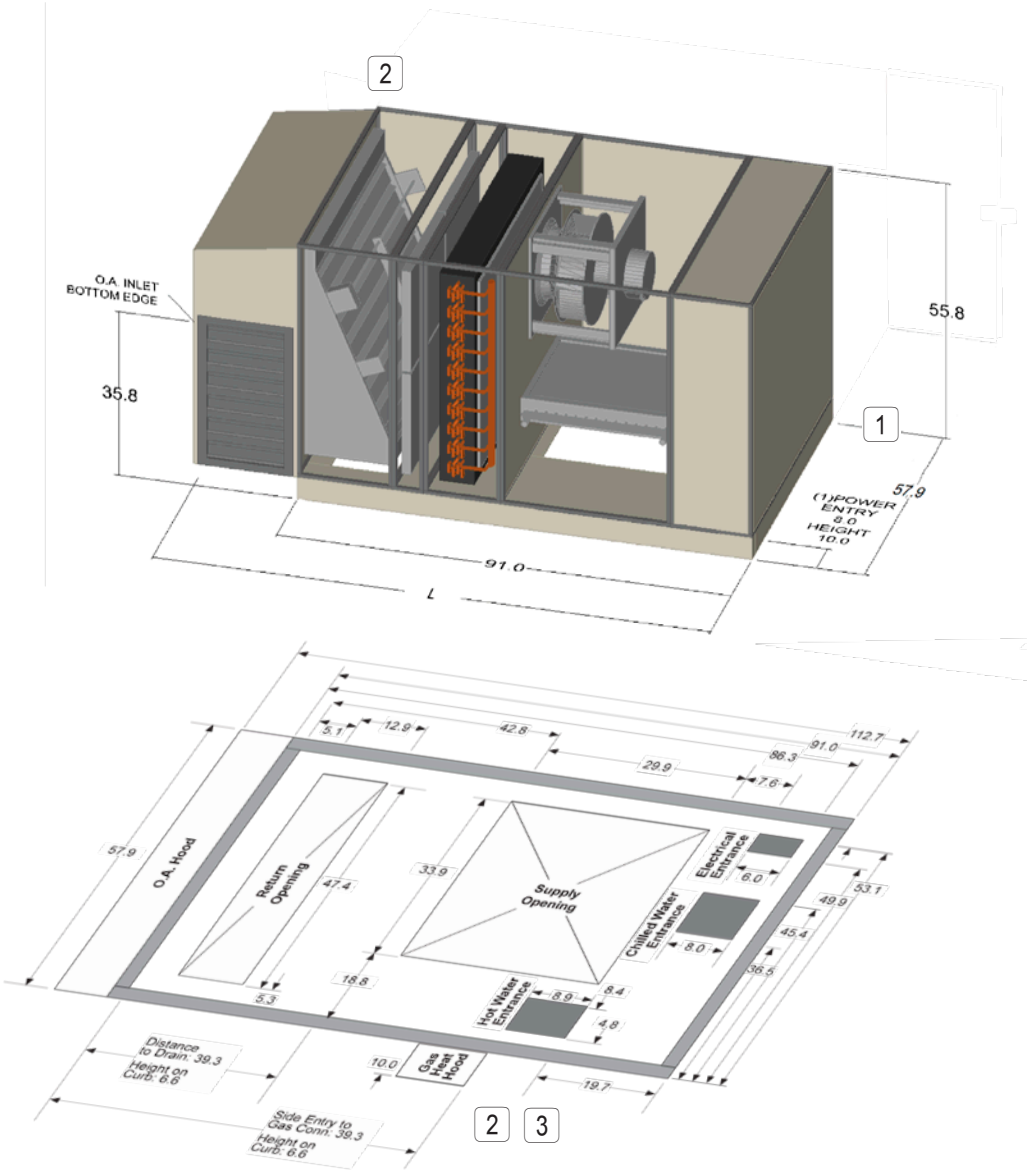
Size (tons)	L
A07–A11	132.7



NOTE: 1. Not supplied on horizontal return or 100% OA units
2. Horizontal, above the roof, gas connection only
3. Not available with horizontal return

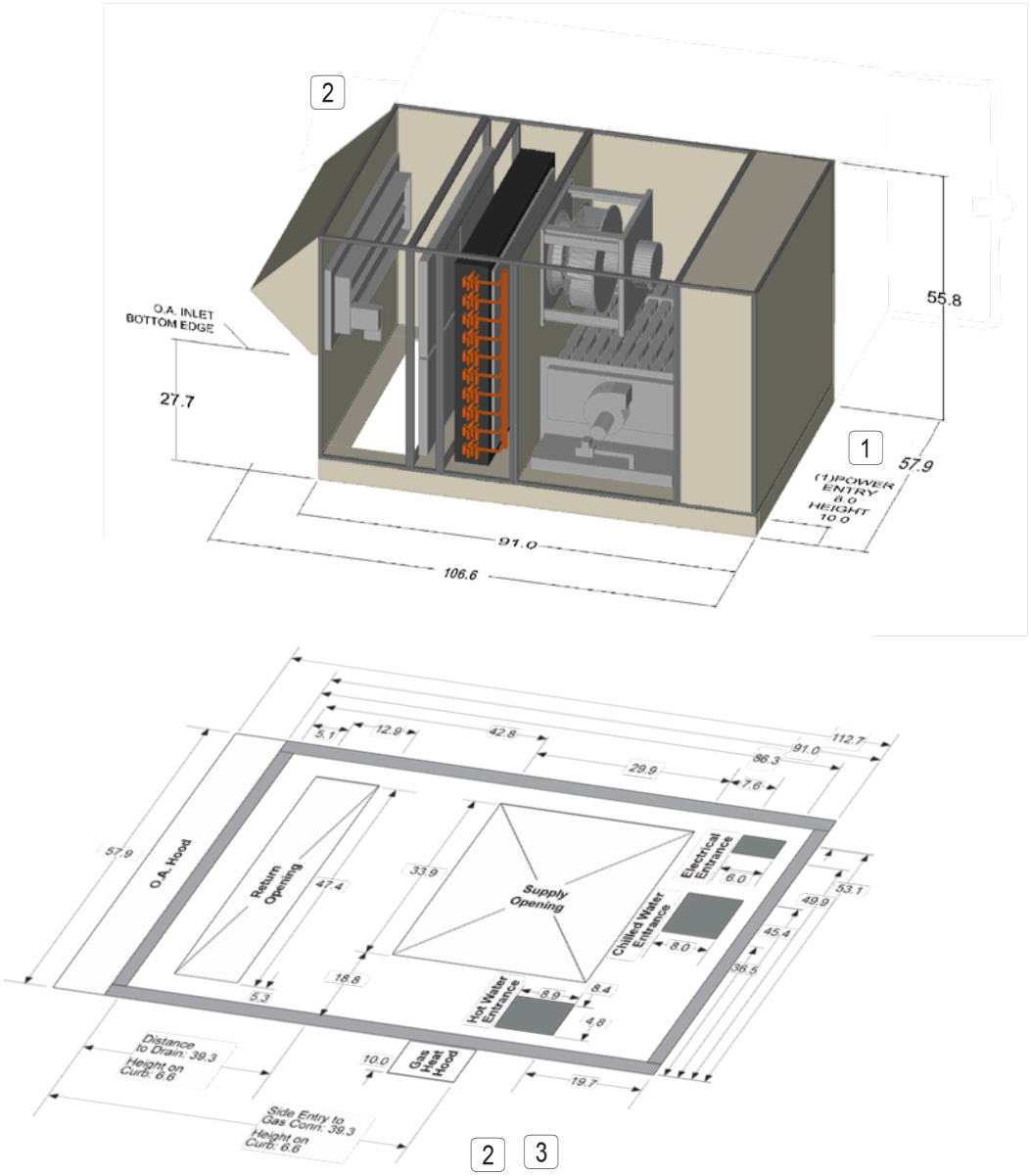
Figure 27: DAH A07–A11, Economizer, No Energy Recovery

Size (tons)	L
A07–A11	112.7



5 **NOTE:** 1. Not supplied on horizontal return units
2. Horizontal, above the roof, gas connection only
3. Exhaust fan not available with horizontal return

Figure 28: DAH A07–A11, No Energy Recovery, 0–30% or 100% Outdoor Air



NOTE: 1. Not supplied on horizontal return units or 100% OA units
2. Not supplied on horizontal return or 100% OA units

Figure 29: DAH A07–A11, CORE Energy Recovery

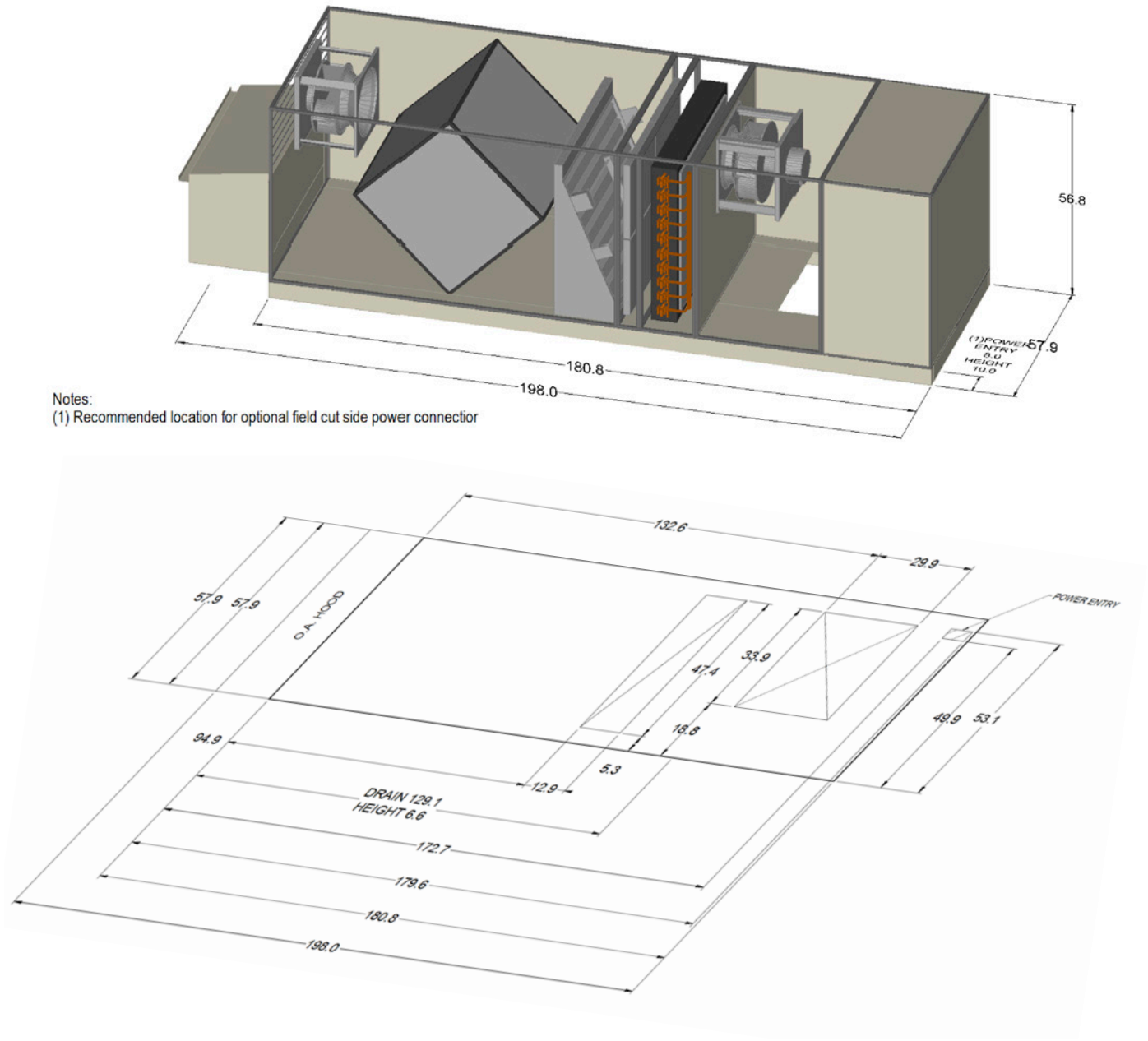
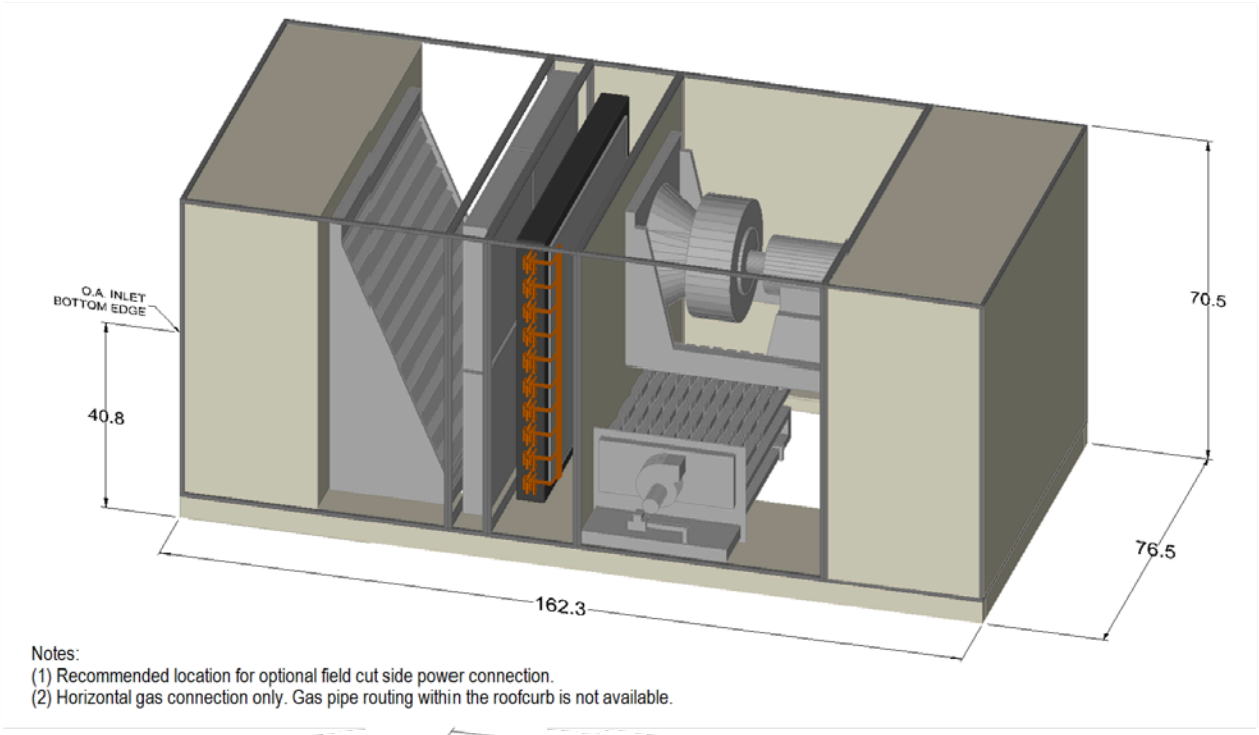


Figure 30: DAH A15–A21, No Heat Recovery



Notes:
(1) Recommended location for optional field cut side power connection.
(2) Horizontal gas connection only. Gas pipe routing within the roofcurb is not available.

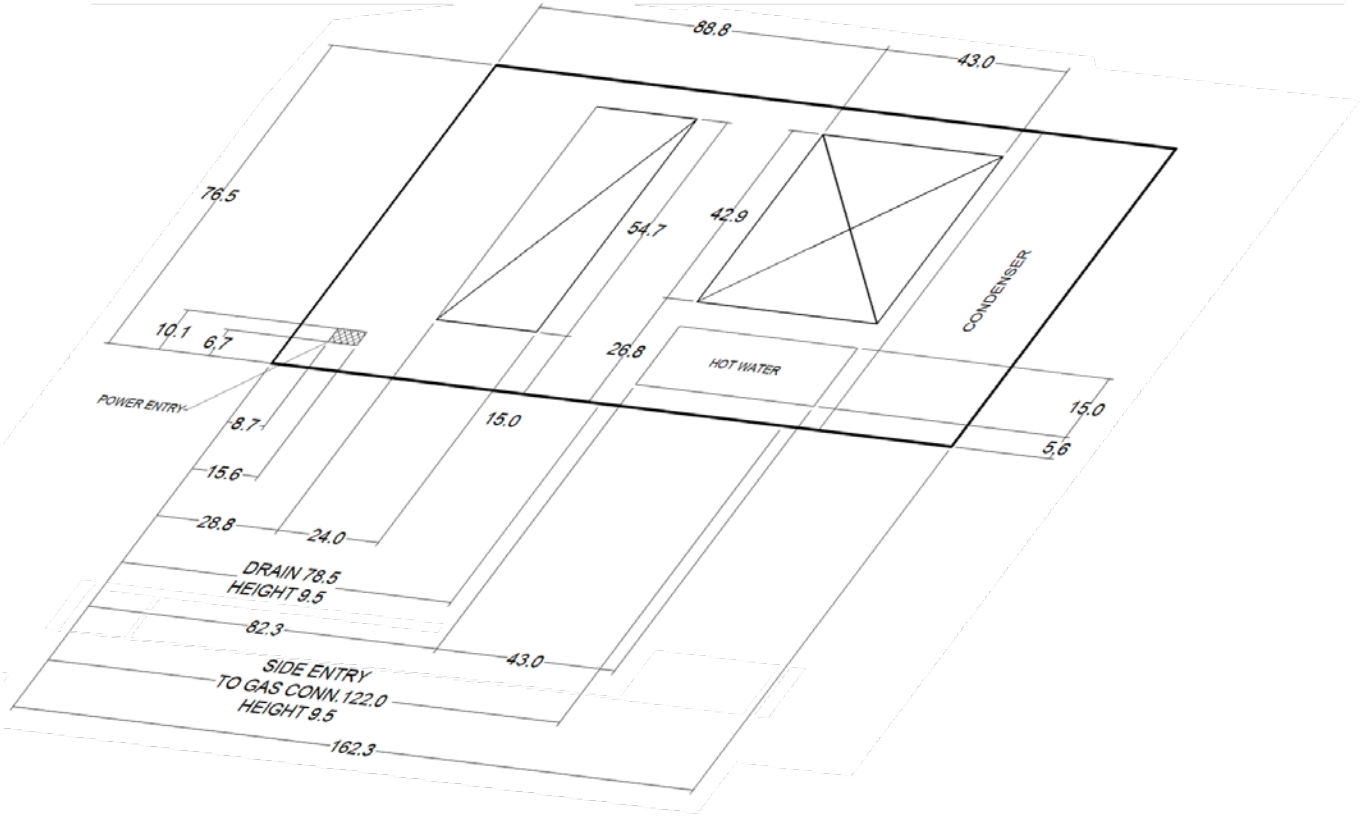
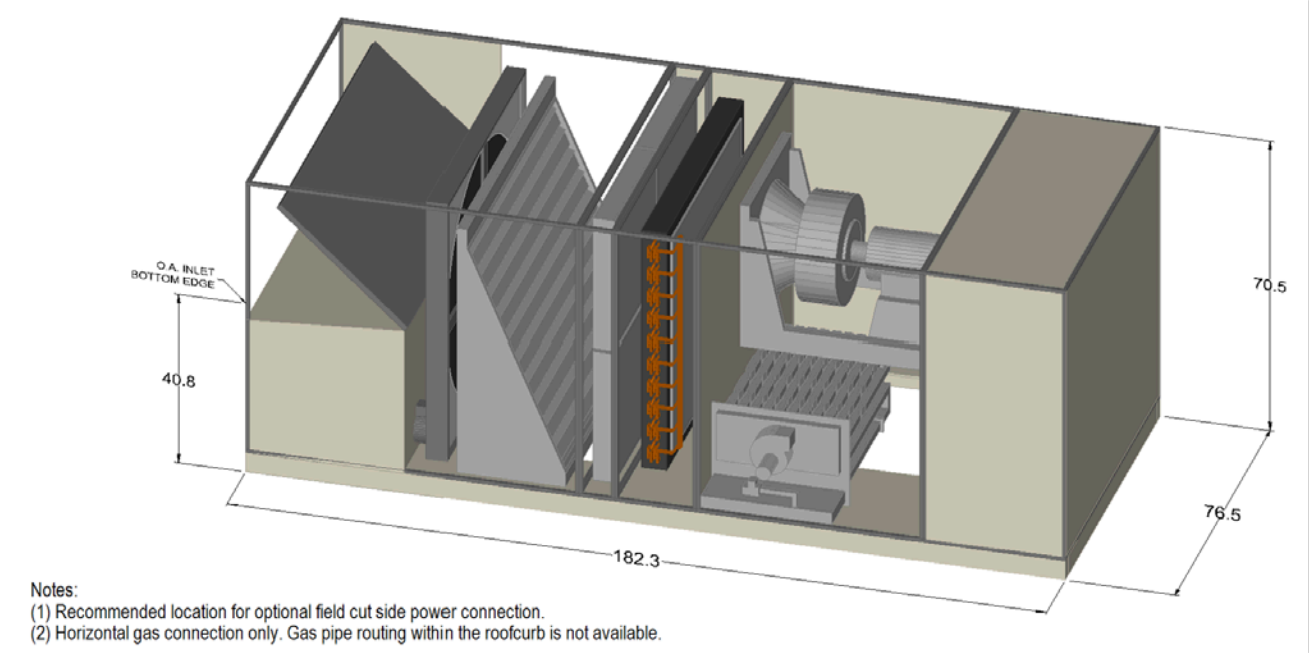


Figure 31: DAH A15–A21, Energy Recovery Wheel



Notes:
(1) Recommended location for optional field cut side power connection.
(2) Horizontal gas connection only. Gas pipe routing within the roofcurb is not available.

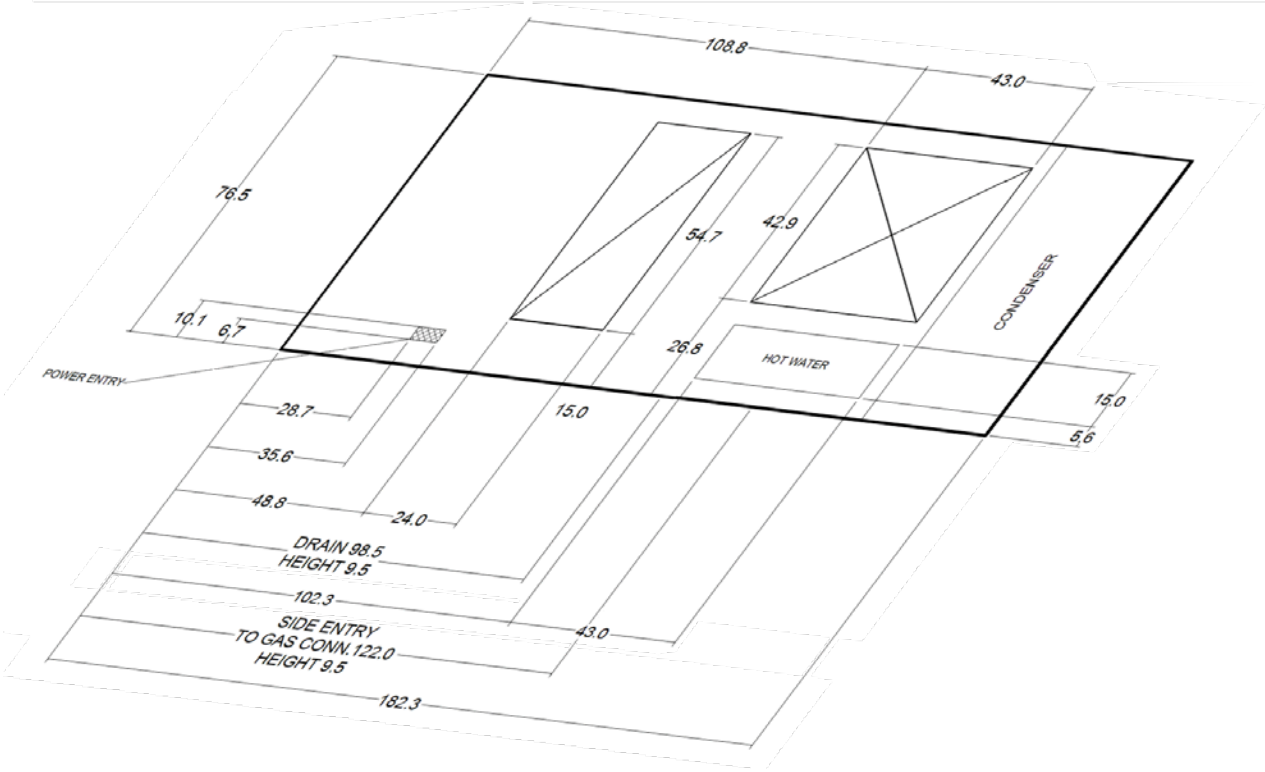
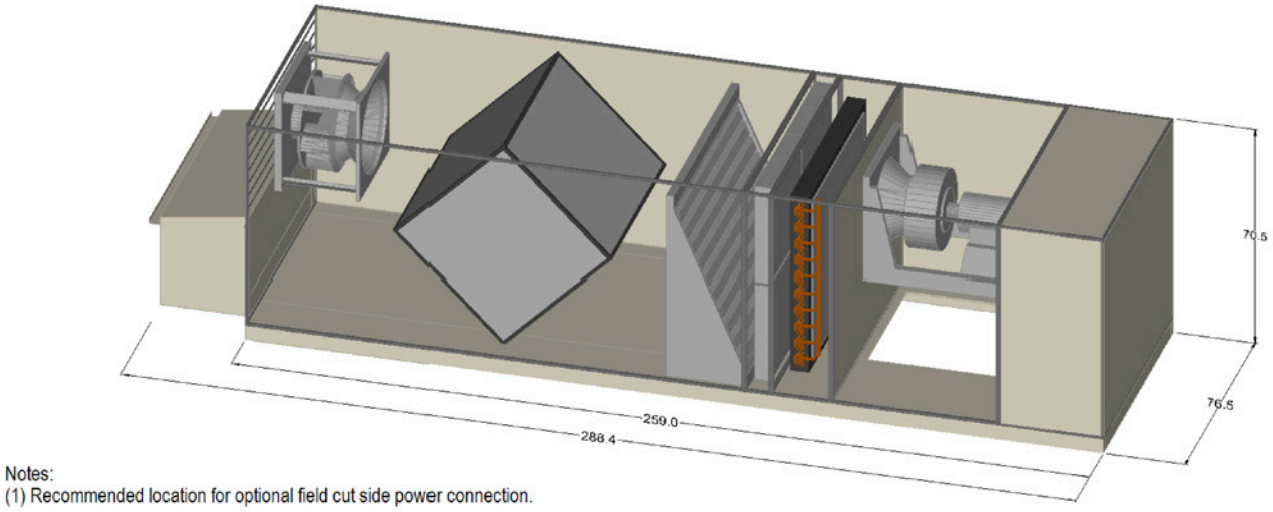


Figure 32: DAH A15–A21, CORE Energy Recovery



Notes:
(1) Recommended location for optional field cut side power connection.

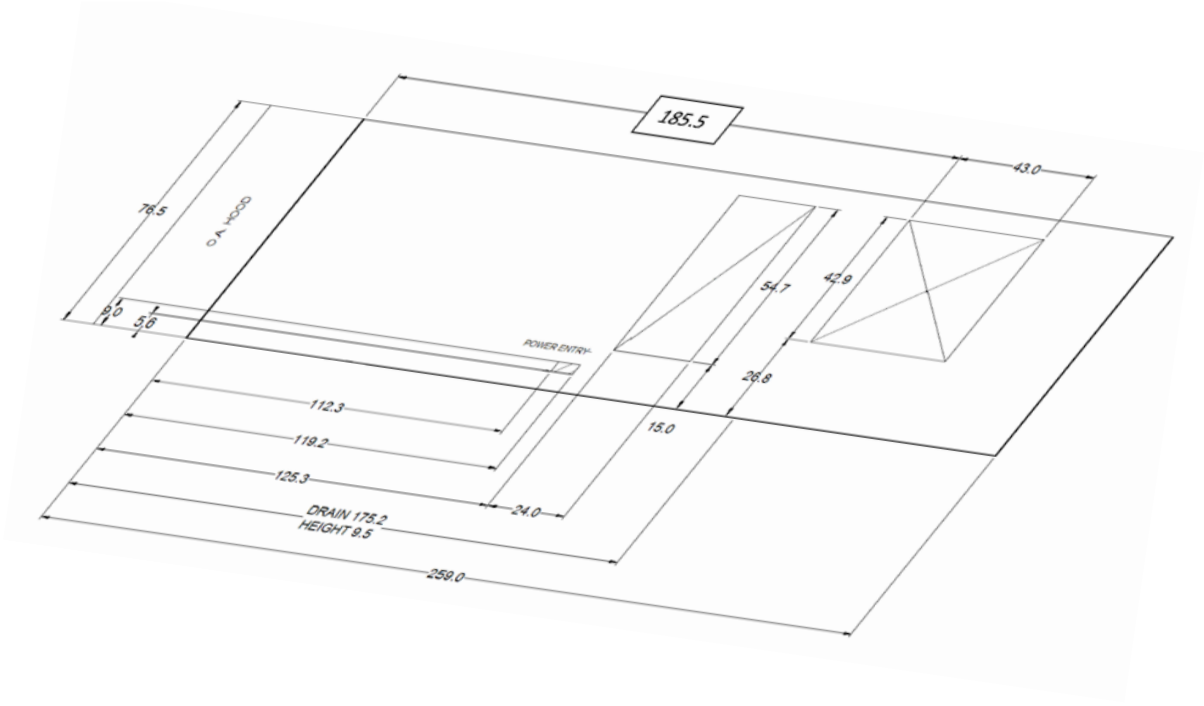


Table 15: DAH A03–A011 Electric Heat Data[1]

kW	Voltage	Amps
6	208	16.7
	230	15.1
	475	7.3
	575	6.0
12	208	33.3
	230	30.1
	475	14.6
	575	12.0
18	208	50.0
	230	45.2
	475	21.9
	575	18.1
30	208	83.3
	230	75.3
	475	36.5
	575	30.1
36	208	99.9
	230	90.4
	475	43.8
	575	36.1
54	208	149.9
	230	135.6
	475	65.6
	575	54.2
72	—	—
	—	—
	475	87.5
	575	72.3

1. Maximum temperature rise equals 60ºF

Table 16: DAH A15 – A21 Electric Heat Data

KW	Voltage	Amps
10	208	27.8
	230	25.1
	460	12.6
	575	10.1
20	208	55.6
	230	50.3
	460	25.1
	575	20.1
30	208	83.4
	230	75.4
	460	37.7
	575	30.2
45	208	125.1
	230	113.1
	460	56.5
	575	45.2
60	208	166.7
	230	150.8
	460	75.4
	575	60.3
72	208	200.1
	230	180.9
	460	90.5
	575	72.4
90	208	250.1
	230	226.2
	460	113.1
	575	90.5
120	—	—
	—	—
	460	150.8
	575	120.6
150	—	—
	—	—
	460	188.5
	575	150.8

Rebel Minimum Circuit Ampacity [MCA] or Wire Sizing Amps

No electric heat

MCA = 1.25 × largest motor FRLA + sum of all other motor FRLA

With electric heat

Must calculate heat mode MCA and cool mode MCA and use the greater value.
Do not include compressors or condenser fans in the heat mode MCA.

Cooling mode MCA = 1.25 × largest motor FRLA + sum of all other motor FRLA

Heating mode MCA where electric heat > 50 kW

MCA = 1.25 × largest motor FLA + sum of all other motor FLA + heater FLA

Heating mode MCA where electric heat is less than or equal to 50 kW

1.25 × [heater FLA + largest motor FLA] + sum of all other motor FLA

NOTE: FRLA = fan motor or controls full load amps or compressor rated load amps
FLA = fan motor or electric heat or controls full load amps
Control amps are:

Voltage	208	230	460	575
Gas Heat Units	2.36	2.16	1.08	0.86
All Other Units	1.18	1.08	0.54	0.43

Table 17: Amp Draw Data

Horse Power	Supply Fan FLA				Exhaust Fan FLA			
	Voltage				Voltage			
	208	230	460	kW	208	230	460	kW
1.3	3.1	2.8	1.4	1.0	3.1	2.8	1.4	1.0
2.3	5	4.6	2.3	1.7	5	4.6	2.3	1.7
4	8.8	7.4	4.0	3.0	8.8	7.4	4.0	3.0
8	13.5	12.2	6.1	6.0	—	—	—	—

575V Amp Draws: Motors will be run off a 575 to 460V transformer. Motors will be nameplated at 460V. 575 voltage is for large cabinet only.

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Packaged Rooftop air conditioners

1.02 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99—Standards Handbook

C. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

D. NEMA MG1—Motors and Generators

E. National Electrical Code.

F. NFPA 70—National Fire Protection Agency.

G. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.

H. UL 900—Test Performance of Air Filter Units.

I. AHRI 410 - Forced Circulation Air-cooling and Air-heating Coils

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
2. Provide computer generated fan curves with specified operating point clearly plotted.
3. Manufacturer's Installation Instructions.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance, and service

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site and inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Daikin Applied

1. No equal exists. [Deducts for alternative equipment will be considered.]

2.02 GENERAL DESCRIPTION

A. Furnish as shown on plans, Daikin Applied Rebel Single zone Heating and Cooling Unit(s) model DAH. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:

1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Gas heating section.

C. The complete unit shall be cETLus listed.

D. The unit shall be ASHRAE 90.1-2013 compliant and labeled.

E. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece.

F. The unit shall undergo a factory run test prior to shipment. The factory test shall include a unit control system operations checkout and a final unit inspection.

G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Performance: All scheduled capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

I. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.03 CABINET, CASING, AND FRAME

A. Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7 and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

B. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished panel surfaces to withstand a minimum 1,000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather tight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.04 ECONOMIZER SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1” differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.

B. Provide factory installed and tested, outdoor air monitor that controls outdoor air +/- 15% accuracy.

C. Economizer assembly shall be California Title 24 compliant. MicroTech III controls shall display a warning, and write a warning to the BAS, if the economizer malfunctions in accordance with Title 24 specifications.

2.05 EXHAUST FAN

A. Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

C. The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.06 COOLING COIL

A. Acceptable coils are to have ARI Standard 410 certification and bear the ARI symbol. Coils exceeding the scope of the manufacturer's certification and/or the range of ARI's standard rating conditions will be considered provided the manufacturer is a current member of the ARI Air-Cooling certification program and the coils have been rated in accordance to ARI Standard 410.

B. Coils shall be designed to withstand 250 psi maximum operating pressures and a maximum fluid temperature of 300°F for standard duty copper tube coils.

C. Coils shall be submerged in water and tested with a minimum 315 psi air pressure for standard copper tube coils. Coils must display tag with the inspector's identification as proof of testing.

D. Coils shall be of plate fin type construction providing uniform support for all coil tubes. Coils are to be manufactured with die-formed aluminum fins with self-spacing collars which completely cover the entire tube surface. The fin thickness shall be 0.0075 +/- 5%. Manufacturer must be capable of providing self-spacing die-formed fins 4 through 14 fins/inch with a tolerance of +/- 4%.

E. Tubing and return bends shall be constructed from UNS 12200 seamless copper conforming to ASTM B75 and ASTM B251. Copper tube temper shall be light annealed with a maximum grain size of 0.040 mm and a maximum hardness of Rockwell 65 on the 15T scale. Tubes are to be mechanically expanded to form an interference fit with the fin collars. Coil tube size and wall thickness are ½" × 0.016. Coil tube size and wall thickness are 5/8" × 0.020 and ½" × 0.016.

F. Headers shall be constructed from UNS 12200 seamless copper conforming to ASTM B75 and ASTM B251.

G. Coil casings shall be a formed channel frame of galvanized steel.

H. The chilled water lines shall be fully insulated to the field piping connections internal to the cabinet.

I. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

J. A drain pan over flow safety shall shut off the unit and issue a warning before over flow occurs.

2.07 SUPPLY FAN

A. Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

B. All fan assemblies shall employ solid steel fan shafts. The entire fan assembly shall be isolated from the fan bulkhead with a flexible collar.

C. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

D. Supply fan and motor assembly combinations larger than 8 hp or 22" diameter shall be internally isolated on 1" deflection, spring isolators and include Size A03 – A11 removable shipping tie downs.

E. The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures.

F. Size A15 – A21 - the motor shall be T Frame and open drip proof. Ovrload protection and speed control is provided by the factory installed VFD and rooftop unit controller. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

G. The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.08 VARIABLE AIR VOLUME CONTROL - FACTORY MOUNTED CONTROLS

A. Size A03-A11 Multiple Zone VAV–The unit controller shall proportionally control the Electronically Commutated Motors (ECM) on the supply and exhaust fans. The supply fan shall be controlled to maintain an adjustable duct pressure setpoint.A duct static pressure sensor shall be factory mounted in the control panel. The field shall furnish and install the pneumatic tubing for the duct static pressure sensor and the building pressure sensor. The field shall furnish and install the outdoor air pressure sensor.

B. Size A03-A11 Single Zone VAV–The unit controller shall proportional control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.

C. Size A15 – A21 an electronic variable frequency drive shall be provided for the supply air fan. Each drive shall be factory installed out of the air stream in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

D. The unit manufacturer shall install all power and control wiring.

E. The supply air fan drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

2.09 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. Each module shall have two stages of heating control.

C. The heat exchanger tubes shall be constructed of stainless steel.

D. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

E. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

F. The factory-installed DDC unit control system shall control the gas heat module. Field installed heating modules shall require a field ETL certification. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the gas heating modules.

2.10 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. An optional fused disconnect and 65,000 amp SCCR capability shall be provided.

2.11 CONTROLS

A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

D. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip

E. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

F. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

1. Return air temperature.
2. Discharge air temperature.
3. Outdoor air temperature.
4. Space air temperature.
5. Outdoor enthalpy, high/low.
6. Dirty filter indication.
7. Airflow verification.
8. Cooling status.
9. Control temperature (Changeover).
10. VAV box output status.
11. Cooling status/capacity.
12. Unit status.
13. All time schedules.
14. Active alarms with time and date.
15. Previous alarms with time and date.
16. Optimal start
17. Supply fan and exhaust fan speed.
18. System operating hours.
    a. Fan
    b. Exhaust fan
    c. Cooling
    d. Heating
    e. Economizer
    f. Tenant override

G. The user interaction with the keypad shall provide the following:
   1. Controls mode
      a. Off manual
      b. Auto
      c. Heat/Cool
      d. Cool only
      e. Heat only
      f. Fan only
   2. Occupancy mode
      a. Auto
      b. Occupied
      c. Unoccupied
      d. Tenant override
   3. Unit operation changeover control
      a. Return air temperature
      b. Space temperature
      c. Network signal
   4. Cooling and heating change-over temperature with deadband
   5. Cooling discharge air temperature (DAT)
   6. Supply reset options
      a. Return air temperature
      b. Outdoor air temperature
      c. Space temperature
      d. Airflow (VAV)
      e. Network signal
      f. External (0-10 vdc)
      g. External (0-20 mA)
   7. Temperature alarm limits
      a. High supply air temperature
      b. Low supply air temperature
      c. High return air temperature
   4. Night setback and setup space temperature.
   5. Building static pressure.
   6. Economizer changeover
      a. Enthalpy
      b. Drybulb temperature
   7. Currently time and date
   8. Tenant override time
   9. Occupied/unoccupied time schedule
   10. One event schedule
   11. Holiday dates and duration
   12. Adjustable set points
   13. Service mode
      a. Timers normal (all time delays normal)
      b. Timers fast (all time delays 20 sec)

H. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
   1. Zone sensor with tenant override switch
   2. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)

I. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
   1. Airflow
   2. Outside air temperature
   3. Space temperature
   4. Return air temperature
   5. External signal of 1-5 vdc
   6. External signal of 0-20 mA
   7. Network signal

2.12 ROOF CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2"×4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

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